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THESIS

INFORMATION CENTERS IN THE UNITED STATES NAVY:
FUTURE SUPPORT FOR A COMPUTER LITERATE SOCIETY

by

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Information Centers in the United States Navy:
Future Support for a Computer Literate Society

by

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Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN INFORMATION SYSTEMS

from the

ABSTRACT

The objective of this thesis is to examine the current state of Information Centers (IC's) in the United States Navy and the necessary steps that must be taken to support future end-user computing (EUC). The current trends in IC development in the corporate environment, pertinent models for controlling and promoting EUC, and the current policies governing existing IC's within the United States Navy are examined providing background for recommendations. The Navy's current strategy for dealing with EUC can be characterized as being in its early developmental stages. Little planning is being done dealing with the promotion or control of EUC. IC's have developed largely in reaction to user demand with little guidance from upper levels of management. As a result, those end-users geographically close enough to existing IC's can make use of their EUC support services. Those removed from the IC's influence suffer from the lack of a support facility. The Navy is at an important stage in supporting EUC growth and development. An increase in bureaucratic controls could stifle EUC growth. Fostering EUC through norm-based reinforcement and strategic support for IC's throughout the service will allow the Navy to capitalize on this new and developing phenomenon. As EUC continues to become more sophisticated in society it becomes increasingly important to develop a strategic policy that allows growth and provides direction to end-users.

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I. INTRODUCTION

A. BACKGROUND

The Information Center (IC) originally developed in the business world as a part of the Information Systems (IS) organization to support end-users of IS services. A key premise behind their development was that users, provided with the proper guidance, software, hardware, and training, could satisfy many ad-hoc applications requirements themselves. This would result in increased user satisfaction while allowing the IS department to concentrate on the larger information processing demands of the organization. (Carr, 1987)

IC's in the United States Navy have evolved from Data Processing Centers in order to meet the needs of an increasingly computer literate society. The leaders and managers in today's Navy have a stronger background than their predecessors in microcomputers and lean more toward developing their own applications. They tend to look to the IC for support and assistance in solving computer-related problems.

End-user computing (EUC) is an environment in which a user with a computer related problem addresses the solution directly. Carr (1987) notes that the rise in EUC coupled with the DP/MIS department's inability to respond to the additional requests spawned by this rise gave birth to the first IC organization.

This research examines the current literature dealing with IC's, the current IC's within the United States Navy, and pertinent models for EUC control and growth. It is important for Navy IC managers to realize that significant forethought

must be given to the services that the IC will provide to support the organization's end-user population.

B. OBJECTIVES

This thesis examines the current trends in IC development in the corporate environment, pertinent models for controlling and promoting EUC, and the current policies governing existing IC's within the United States Navy. The primary objectives of the research are to identify what the Navy's current IC policy is and where the Navy eventually wants to be with respect to EUC, and to suggest an EUC control strategy to allow the Navy to reach its goals.

In attempting to address these issues, the following subsidiary research questions must also be considered:

1. How do IC's in the Navy compare with those in the corporate world?
2. Are IC's in the Navy demand (user)- driven or organizationally directed?
3. What control functions do IC's currently serve in the United States Navy?
4. What is the current policy on IC's and how did it evolve?
5. What are the long range goals for IC's in the Navy? Specifically, how does the Navy plan to deal with EUC in the future?
6. What model of development can be followed to allow IC's to evolve and support a more sophisticated end-user while still maintaining some degree of control?

C. METHODOLOGY

The main thrust of this thesis is to develop a management guide providing Navy IC Managers a method of controlling EUC without stifling its growth. Specifically, this thesis:

1. Examines the current literature on IC's in the business world concerning trends, organization, and effectiveness.

2. Examines the current United States Navy directives concerning IC's looking specifically at functions, charging systems, and future trends.

3. Provides the viewpoint of selected IC managers and users to determine how they attempt to measure their IC's effectiveness.

4. Provides the viewpoint of selected officers and management personnel in the Navy Data Automation Command, Washington D.C. and the Naval Regional Data Automation Centers of Norfolk, Va and Washington D.C. to determine what directions are planned for IC's in the future.

D. SUMMARY OF FINDINGS

The most successful IC's today are those in which management keeps close track of the parent organization's strategic goals, ties the IC's development and services to those goals, and contribute to the larger organization's profits in a positive way.

IC's within the United States Navy have developed largely without direction or policy from upper level management. As such, there is little standardization among the various IC's that exist. Navy IC's also suffer somewhat from the Navy Industrial Fund (NIF) method of funding their operation. It forces IC managers to emphasize services with the highest monetary payback even though these may not have the highest priority from the IC's perspective. For example, many end-users

require basic instruction in wordprocessing or spreadsheet utilization. Because these services do not offer as great a monetary return as local area network (LAN) installation they tend to receive less emphasis. NIF funding is not without its benefits, however. It does make an organization "earn" its keep rather than rely on annually appropriated mission funding support. However, until such time as end-users realize the importance of services such as on-going training and consulting, it might be prudent to mission fund some portion of the IC's activities. This would allow the IC to offer the services that they feel are required, without worrying about NIF considerations. Once end-users realize the importance of the IC's services, a shift to total NIF funding would be possible.

E. ORGANIZATION OF STUDY

The structure of the remainder of the thesis is described below.

Chapter I, A Survey of IC Trends, examines the current literature dealing with IC operation and development. It presents an up-to-date picture of how IC's operate in the business world and some keys to success that have been discovered. IC benefits and obstacles are also enumerated.

Chapter III, EUC: A Model for Control and Growth, examines current literature dealing with EUC. Various control and growth models are examined with possible applications for Navy IC's to manage the growing phenomenon of EUC.

Chapter IV, U.S. Navy IC's: Current Policy, examines the current chain of command for IC's in the Navy, the policy that governs existing IC's, the issue of NIF funding for IC's, and how IC's have developed in the Navy in the absence of definitive policy guidance.

Chapter V, The Future of End-user Computing in the Navy, deals with the future of IC's within the Navy, based on interviews with key personnel within the chain of command. This chapter applies the models for controlling EUC discussed in Chapter III to IC's in the Navy. Different circumstances are presented depicting possible outcomes based on policy decisions.

Chapter VI, Conclusions and Recommendations, summarizes the findings identified in previous chapters. Specific recommendations are also made to various positions with the Navy that might improve the operations of IC's.

II. A SURVEY OF INFORMATION CENTER TRENDS

This chapter examines the literature dealing with Information Centers (IC's) in business organizations. The evolution of IC's is discussed, normative implementation and organization methods are proposed, IC benefits and obstacles are detailed, and guidance is provided for insuring the success of IC's in the future.

A. HISTORICAL PERSPECTIVE

The original Information Center (IC) concept dates back to 1974 when IBM-Canada addressed the need for an alternative to the formal Management of Information Systems (MIS) methods of computer-based development. The large number of requests for computer systems and computer-based solutions backlogged the MIS department to such an extent that they created a support group to help users satisfy their information needs directly and to free the MIS staff to handle the larger computer based application requirements of the company. Eventually, the support group became known as the IC.(Carr, 1987) The departments known as IC's soon became the focal point for supporting End-User-Computing (EUC) throughout many other firms experiencing user discontent with the existing MIS department.

The objective of the IC is to provide users with a set of tools, training in the use of those tools, and access to required data for solving business problems with the applications that they have created. (Hammond, 1982)

L. W. Hammond's paper, published in the IBM Systems Journal in 1982, is considered a landmark publication concerning IC installation and organization. His discussion of the IC's mission, staffing, and organization prompted IBM to formally adopt the IC concept and to offer it to their clients. The IC was designated as a part of the Information Systems (IS) organization dedicated to supporting users in the development of their own solutions to computer based requirements. Those users requiring report generation, data manipulation and analysis, or spontaneous inquiries could go to the IC for help by knowledgeable professionals.

> The fundamental premise underlying an IC is that if provided proper education, technical support, usable tools, data availability, and convenient access to the system, users may directly and rapidly satisfy a portion of their business area requirements that depend on an I/S environment.(Hammond, 1982, p. 131)

The growth of IC's was stimulated by the attitudes that users and IS personnel held about each other. Users felt that the IS department was not responsive to their needs, did not deliver the product that they asked for, and was inflexible regarding any changes that the users might request. The IS staffer, on the other hand, felt that users were unreasonable by modifying their requests with no regard for the implications. They also felt that the users always changed their minds about what they wanted. (Hammond, 1982)

This conflict between users and staff gave the IC a reason to exist. By recognizing the validity of each side's complaints and creating a vehicle for solving them, the IC could assure itself a niche in the IS organization.

Hammond (1982) viewed the IC as a new user-IS working relationship founded on cooperation and a common desire to do a quality job. The relationship

was beneficial to both parties. The users could get their jobs done more efficiently freeing more time to attend to other business matters. Any last minute changes could be incorporated because the users were the ones building the application. The IS staff was satisfied because it reduced conflict with the users, decreased their backlog, and all but eliminated maintenance on user-generated applications.

In Hammond's model the IC must provide training to the users so that they can readily use the tools provided. This can take the form of classroom instruction, self-paced video instruction, or "hands on" training with IC staff professionals present to answer questions. (Hammond, 1982)

The IC should also provide technical support as consultants, product specialists, and department specialists. There should be at least one expert on the IC staff proficient in each of the areas supported by the IC. The IC staff should also be knowledgeable concerning new products that the users might conceivably request. Finally, the staff personnel should have some expertise in the various departments that the IC supports so they can understand the business problems that users bring to the IC. (Task, Inc., 1986)

The IC must allow user access to various systems within the IS organization. Communication protocols, graphics packages, and security programs should also be available to users. (Hammond, 1982) IC users should feel confident that their data is as secure as it would be with a traditionally developed application.

As microcomputer technology exploded in the early 1980's the role and acceptance of the IC increased greatly. (White, 1987) Now the IC was forced to

deal with users who did not need access to a mainframe and who had a work knowledge of their micro.

> With the widespread acceptance of the microcomputer, and the accompanying acceleration in computing literacy, the information center of the 1980s has become a dominant factor in organizational computing. (White, 1987, p.451)

The IC is not only a facility for end-users to solve their computing needs, it is a strategy for management to influence, support, and control end-user computing (EUC) (Task, Inc., 1986 p. 2.1). Management can set policies and priorities and then communicate these controls to the end-users through the IC. The IC can then serve as a feedback mechanism to management on the effectiveness of the control measures. Again the IC atmosphere is critical to its proper functioning. Both users and IS staff personnel must view the IC as a win/win situation. A common goal of satisfying the users' computing needs in less time and freeing the IS staff for other computing needs must be viewed by all as good for the business. In this cooperative atmosphere the IC can flourish.

B. INFORMATION CENTER IMPLEMENTATION AND ORGANIZATION

1. Identifying ADP Plans and Organization Needs

The long-term success of an IC depends upon an establishing a link between the IC strategic plans and the strategic plans of the organization. Henderson (1988) argues that IS planning should encompass three distinct areas: external validity, internal consistency, and cooperative behavior.

External validity can be thought of as the staff's efforts to insure correctness in the planning process. The chosen strategy must be robust, valid, and should stand up under the same critical examination as any other strategic plan.

Internal consistency strives to link beliefs, assumptions, and behaviors of the IS individuals to the more abstract behavioral or process model of the firm through a series of well-defined means/end relationships.

> The dominant focus of most IS planning methodologies is the creation of an internally consistent behavioral or process model of the firm.(Henderson, 1988, p. 189)

The need for cooperative behavior among the IC planners is a major component of any future success. Strategic plans generated for the IC must be the product of cooperation among the information experts and reflect the long range planning desires of upper management.

Significant issues must be addressed when identifying the corporate plans for the IC to insure that the IC provides all services needed in a cost-effective manner. Thought must be given to the types and amount of hardware that the company will be acquiring in the future. Software applications and development for the company must be considered. The IC will need to have staff experts on the various systems and software that the company purchases by the projected installation dates. The IC planners must also determine which groups within the company they are going to target as customers. Carr (1987) discusses six different categories of end-users ranging from the non-programming end-user whose only access to computer stored data is through software provided by others to DP programmers who actually program in end-user languages. The planners must focus the IC's support efforts on the users' level of expertise. In developing an end-user profile, emphasis must be placed on where they are located, what work they

perform (Ops Analysis, DBMS, spreadsheets, communications, etc.), and their current literacy and skill level. (Carr, 1987)

IC planners must give thought to what applications they will promote, what training and support will be required, and what resources will be allocated to the IC to perform their mission. The underlying theme is that planners must address the critical issues early in the IC implementation process. Linking the strategic goals of the IC to those of the business offers the best hope that the IC will remain a viable entity within the organization as it evolves.

2. Identifying IC Philosophy, Mission, and Function

The IC must be based on a philosophy conducive to learning, and supportive of the creativeness that EUC fosters. The IC should influence rather than control users. IC staff members should provide options for the users rather than mandate solutions. Although other, more bureaucratic operations do exist where end-users are directed rather than supported, their effectiveness can be questioned. Recent EUC literature (Euske and Dolk, 1988) lends support to norm-based strategies that move away from bureaucratic controls to promote EUC. Ambrosio (Ambrosio, 1988, p. 58) states that users should decide what they want done, the IC should determine the options, and the users should then make the final choice. The philosophy should be one of assisting vice doing. End-users should not look to the IC for completed solutions but for help in designing their own solutions. Finally, the philosophy should be one of training not production. The major IC deliverable should be more sophisticated end-users, not software applications.

The IC's mission statement is an extremely important document for defining its function in the larger IS environment and the roles and responsibilities of the users and the IC staff. Hammond (Hammond, 1982) suggests that the mission statement should be divided into three sections. The first section describes what the IC is. Statements concerning the environment to assist users, the interface between the IC and established project teams, planned expansion based on usage and user input, and marketing the IC within the organization should be included here.

The next section of the mission statement describes how the mission will be accomplished. Hardware and software issues, user needs and feedback, IC staff technical competence, and methods of user training are discussed. The last section details the criteria for work appropriate for the IC and, to some degree, what is not appropriate. Duration of effort, complexity of the task, level of user participation and frequency of execution are addressed.

The mission statement emphasizes to all levels of users and staff that the IC is not a substitute for applications that require extensive systems analysis and design. The IC is designed to complement the existing IS organization by handling the one time, user produced tasks. It is not a vehicle to circumvent the traditional analysis and design required for large systems.

In identifying IC functions and services IC planners should strive to detail how the IC should serve while allowing itself to evolve as users become more sophisticated. An IC should provide guidance, concepts and skills training,

technical advice, assistance and support, liaison with vendors and policy makers, and coordinate resources available to the users. (Task, Inc., 1986, p. 3.4)

The IC must remain responsive to the users' changing demands. As business needs change, the users' needs for IC services will change. Features such as a help desk, a newsletter to dispel technical fears and promote goodwill, and meetings between IC staff and end-users are methods of staying abreast of the user desires for information services. (Curtis and Forman, 1986)

3. Placing the IC in the Organization

Careful consideration must be given to the placement of the IC within the organization. If the center is located too high in the structure it could be viewed as a tool of the existing IS department and not for the users. If placed too low, it could be viewed as belonging to only the functional manager under whom it is placed and not to the organization as a whole. Hammond (1982) recommends placing the IC at the level of the development managers so that it has equal status with the project-oriented work ongoing within IS and so that it is available to everyone.

End-users must be receptive to the IC placement within the organization. A user must not feel that the IC is only for upper level management or that it belongs to another department. The users must have easy access to the IC. An IC that is guarded by receptionists and secretaries within another department will not enjoy as much success as one that is more open to all users.

A prime consideration when placing the IC within the organization should be its continued visibility and support. Again, it should be accessible to all users

and not controlled by a single functional manager. An effective level used in some organizations places the IC Manager at the same level as the Data Base Administrator or Data Management Department Head (Hammond, 1982).

4. Planning the Staff

Planning the IC staff begins with a review of the plans made for the mission, functions, and services to be offered. With this focus in mind the planners can determine the makeup of the staff needed to support the requirements.

For a start-up operation a manager plus two or three IC consultants would be sufficient (Hammond, 1982). An IC should not attempt to offer a wide variety of packages from the start. A combination of two or three packages supporting a limited number of users will allow the IC to become established more easily. As the user population and IC acceptance grows, the staff can add more packages and expand accordingly.

In the case where IC acceptance is initially high or there are numerous users competing for IC services, management can document the organization's need for the IC and enlarge. Management, however, must remain cautious in any expansion phase. User requests for additional services must be thoroughly examined for validity. The situation where the IC has overexpanded and then underutilized after its "newness" has worn off must be avoided. (Hammond, 1982)

The IC manager is a critical staffing consideration and can ultimately determine the success or failure of the IC. The manager should be a self-motivated team player who can get the job done with little or no guidance. The individual must have a well rounded background. Roots in DP are important but the manager

must also understand the business workings of the entire company. The IC should support the business needs of the company and, through the manager, must keep abreast of the business as it evolves. The manager must be able to communicate well with other leaders in the company. The manager's ability to sell the IC concept to upper level management is most important. The manager is the keystone of the IC. Decisions made by the manager will chart the course for IC success or failure and management must give this appointment the utmost attention.

The IC staff members hired must be able to perform well as consultants, product specialists, teachers, and terminal assistants. In the role of consultant, the staff must review the inputs from the users and formulate concise IC support requests. The consultant should also screen the requests from users to ensure that the request is in keeping with the guidelines established for the IC. (Hammond, 1982)

As product specialists, the staff members must be experts on the uses and function of the package for which they are responsible. They must be adept at utilizing the product to provide users with applications that solve their business problems. The staff must also have a working knowledge of other packages supported by the IC in order to refer users to products that might better suit their needs.

In their role as teachers, the staff provides the users with the knowledge of how to gain access to the products and how to use them to solve their problems. The skill levels of the end-users will vary considerably requiring the staff to survey the users and customize their teaching methods accordingly. All staff members

should be able to provide some level of terminal assistance. Sign on procedures and command syntax are areas with which users will need initial help and which will have a direct impact on how the users view the support provided by the IC. (Hammond, 1982)

5. Planning the Facility

The planning and selection of the physical facility for the IC should be based on several important considerations. First, Hammond (Hammond, 1982) notes that the manager and staff should be located so as to be easily accessible to the users. The staff should have individual cubicles so that they can work with users and remain undisturbed. There should be at least one unassigned area with several terminals, if the IC supports mainframe use, and microcomputers available to users. The IC staff must also have access to an instructional area, separate from the terminal/microcomputer area, to conduct their training.

Careful consideration should be given to the security of the IC. Hammond implies that as users gain proficiency, they will want terminals and microcomputers installed in their own offices to save time. Taking terminals out of the secure IC could lead to problems if key locks are not used or the terminals are located in unsecured areas. The IC staff should retain responsibility for any exterior terminals and microcomputers to continuously monitor their security. (Hammond, 1982)

6. Selecting the Equipment

Deciding what technology should be included in the IC starts with a survey of the existing equipment within the organization. Equipment that is

commonly used throughout the organization should be included in the IC. Users should be able to go to the IC for help with systems that they already own and will continue to use.(Task, Inc., 1986) If the IC is considering purchasing a newer (enhanced) version of an existing model, care must be taken to ensure that the user interface is the same and that the users can also acquire the enhanced version.

The IC staff also needs access to equipment for training and demonstration purposes. Complete equipment systems should be available for demonstration and use in the IC, separate equipment should be available for self-study (computer-based training), and separate systems should be provided for hands on training (e.g., printers, modems, monitors).

Completing the equipment inventory, the IC staff needs to have access to the technology needed to support internal administrative activities, assist end-users, and meet information and resource needs. Specifically, equipment for document and slide preparation (e.g., laser printers, slide makers, text scanners), electronic mail, desk top publishing, and local area network access will be required. (Task, Inc., 1986)

The great success that IC's have enjoyed with Computer Based Training (CBT) gives IC planners strong reason to consider acquiring hardware to fully support all anticipated CBT uses. The 1987 CRWTH Survey of IC's (CRWTH, 1987) reported that CBT was the number one technique for increasing IC staff productivity. Having the hardware to support CBT can help IC management deal with problems of having enough qualified data processing trainers, meeting scheduled deadlines, and improving the economic benefits of the IC.

7. Selecting the Software

The software selection process closely resembles the process used to select the hardware for the IC. Planners must acquire the end-user software, the software for internal use, and must establish guidelines for the staff to evaluate future software. Again, the philosophy and mission of the IC, the goals and planned services, the limitations and needs of the end-users, and, most importantly, the long-term strategic goals of the organization are factors that input into the software purchase decision.

End-user software can be divided into the two broad areas of mainframe/minicomputer software and microcomputer software. The mainframe/minicomputer applications; fourth generation languages, DBMS, Graphics, Statistics, Decision Support (DSS), and Executive Information systems will closely parallel the existing organization software. (Task, Inc., 1986) The microcomputer applications (i.e., DBMS, Spreadsheet, Graphics, DSS, and Artificial Intelligence (AI) programs) can be tailored more closely to the end-users' desires, but should be limited to those applications that the IC can support without overtaxing the staff causing the support's quality to suffer.

Another area of software selection is network software to connect micros to mainframes. As office automation increases the IC will be forced to provide more and more support for micro-mainframe links, terminal emulation, and local area networks.

IC staff personnel will require software to enhance their training and support functions and to facilitate the production of tools and IC administration.

(Task, Inc., 1986) Graphics software, CBT packages, troubleshooting tools, bulletin board software, and desk top publishing applications are only a few of the required software packages.

The IC staff must be able assist in the evaluation of software packages and help determine their worth to the organization prior to purchase and implementation. The staff can make use of periodicals, rating services, conferences and expositions, and on site vendor demonstrations to help in the evaluation process. User friendliness, performance, cost, the long-term viability of the product, and the product's relationship to the organization's existing environment are the major areas that staff must rate and evaluate against other products available.

A goal of the IC is to provide the users with software packages that will best suit their needs. Careful evaluation of the available software, with the organization's strategic goals in mind will help the IC survive.

8. Developing an Operational Budget

Often overlooked in the planning stages is the development of a working budget. The budget will be instrumental in determining the costs and benefits of the IC when it comes time to justify the IC's existence. Rather than just a piece of paper that comes out once a year, the budget should be a working tool that can give the IC management an indication of the center's financial status. Management should devote time to the budget formulation process and uncover all of the hidden costs of operation. Telecommunication access fees, security, publications, conferences, and consultant fees are only a few of the costs that might not be considered initially. (Task, Inc., 1986)

Kelleher (1986) advocates that to prove their worth, IC's keep accurate performance records. Many different methods are cited ranging from informal surveys of programmer hiring rates after IC implementation to complete cost/benefit analyses. Kelleher contends that an effective IC should reduce the requirement for additional programmers. The budget, if it is a true reflection of the IC operational costs, can be used as a tool in the cost-benefit analysis. Establishing the IC as a profit center is an important concept in the future of IC's and will be discussed in more depth.

C. INFORMATION CENTER BENEFITS

In his initial presentation on IC's, Hammond states:

> The Information Center establishes a new user-I/S partnership which will benefit the entire organization. Users benefit because their short-term, often one-shot, I/S-related business needs can be addressed immediately. I/S benefits because it can satisfy the short-term, one-shot user needs in a more efficient manner, thus being able to devote more of its resources to new project-oriented development....(Hammond, 1982, p. 159)

Indeed the IC has benefited the organization as a whole in many ways. Increased job productivity, enhanced(more competent or literate) users, an enhanced view of DP, and improved decision making are the main benefits seen in firms that have implemented IC's. The reduction of the Data Processing Center's backlog, a benefit Hammond thought would arise, has yet to materialize. (CRWTH, 1987)

1. Increased Job Productivity

The goal of any profit-minded business is to provide its people with the resources required to complete their jobs in the most efficient manner. Given the proper tools, people can complete their business functions faster and have more time

to tackle other jobs and problems. The evolution of EUC and the IC's support for EUC have provided a means for users to bypass the long delays associated with DP and receive their completed projects in a more timely manner.

In their 1987 survey, CRWTH reported that fully 80 percent of the 450 firms surveyed cited increased job productivity as the primary benefit of IC's. (CRWTH, 1987) Using tools provided by the IC, users are now automating their routine, time consuming tasks with computer generated reports, spreadsheets, and databases.

2. Computer Literate Users

As end-users learn to rely upon themselves for the answers to their computer-oriented business objectives, they become more and more comfortable with computer environments. This growth in computer literacy results in users being less resistant to changes involving computers.

CRWTH (1987) reports that 70 percent of the firms surveyed benefitted from improved computer literacy. The IC functions as the vehicle to deliver computer information to the users. The better an IC is at training end-users, the more computer literate they will become. This can then effect the job productivity, increasing it even more. End-user training and job productivity are closely tied in this respect.

3. An Enhanced View of DP

Another benefit of the IC is a thawing of the relationship between end-users and the Data Processing Department. Over half (58 percent) of the companies surveyed experienced this as a benefit. (CRWTH, 1987)

Prior to the advent of the IC, end-users were faced with long backlogs, untimely turnaround, and what they perceived to be unfriendly people in DP. Data processing personnel had little time to interface with the users and felt frustrated with them when they changed requirements. (Hammond, 1982) The two conflicting perceptions resulted in a chilly DP/end-user relationship.

The IC has allowed end-users to work together with DP personnel on their business applications. They have been exposed to the computer technology and better realize how hard it is to deal with changing requirements. Users now have a facility to obtain the answers to their questions and see timely turnaround.

4. Improved Decision Making

The value of information to a corporation is unlimited. Armed with the right information, executives can make better business decisions, more rapidly, and with more confidence. Better use of information technology to improve decision making was experienced in 70 percent of the firms surveyed by CRWTH in 1987.

> Business professionals who have access to corporate information can react faster and better to changes in the marketplace and thus sharpen their corporation's competitive edge. (CRWTH, 1987, p. 3)

5. DP Backlog Reduction

While the actual backlog that DP faces has not decreased with the inception of IC's, they are generally credited by IC managers and corporate-level users observed by CRWTH (1987) with reducing the "invisible backlog". End-users take care of certain jobs themselves in the IC. The backlog has not decreased because more and more people are becoming exposed to the value of DP and the

IC. The jobs that the IC has taken have been replaced with other jobs created by users in search of more information. (CRWTH, 1987)

In effect, Hammond's IC concept still rings true. "The total organization benefits because a scarce and valuable resource is used in a more effective and cost-efficient manner." (Hammond, 1982)

D. INFORMATION CENTER OBSTACLES

As impressive as the benefits of IC's are, there still exist obstacles to their development and maturation. As the IC's have matured the hurdles have changed. Lack of end-user awareness, once the biggest obstacle of the IC, has become less so as the users gain more and more computer experience. (CRWTH, 1987) The lack of DP training personnel and continuing management resistance are two additional impediments that have not decreased as much as end-user awareness.

The lack of DP trainers was found to be the foremost obstacle to EUC by the CRWTH survey. The proportion of IC's reporting a lack of training personnel increased from 39 percent in 1985 to 42 percent in 1987. (CRWTH, 1987) As the technology changes in the computer industry and user needs change within the organization, the value of training increases dramatically.

Two techniques that IC's have adopted to combat the trainer shortage are the creation of user community IC liaisons and Computer Based Training (CBT) discussed earlier in the chapter. (CRWTH, 1987) The liaison concept supplements the limited IC staff with departmental "power users", the most qualified end-users. These power users become the focal point for business computing questions within

the user community. The power users broaden the range of the IC, allowing it to reach more end-users with the same number of actual IC staff.

Management resistance to IC's stems mainly from the IC's inability to justify their existence and their resources. The intangible benefits that management accepted when the IC was established; increased end-user awareness, better decision making, and "invisible backlog" reduction; are no longer enough to justify the IC on their own. (Kelleher, 1986)

> By training corporate staff, by assisting in identifying new opportunities and by fostering the use of new technologies in the corporate environment, the information center has, in effect, put itself out of business. (Klein, 1987, p. 30)

Kelleher (1986) suggests that as IC's mature they should shift emphasis to reaping large paybacks in productivity by putting their resources behind strategic business applications. As the organization evolves the IC must stay in synch with the evolution and provide support in new areas. The justification will come with the increased profits and efficiency that can be directly linked to IC's with appropriate control mechanisms established.

E. FUTURE INFORMATION CENTERS

IC's, like the organizations that they support, are in a constant state of evolution. Not only must IC managers keep track of the strategic business goals of the organization, but they must stay on top of the technological advances that must be supported. The continued existence of IC's depends upon how well managers react to changes and provide timely support to users and upper level management.

Four areas that must be emphasized to provide the IC with the greatest chances of survival are strategic business planning, marketing the IC's contribution to end-users and top management, establishing the IC along the lines of a profit center, and emphasis on setting priorities. These four areas are by no means the only ones that IC managers must concern themselves with in every day business dealings. They do, however, provide a basis for pointing the IC in the direction of continued growth, in parallel with the organization.

1. Strategic Business Planning

The long range plans of the IC must be consistent with and validated by the strategic plans of the organization. Henderson (1988) proposes that attention to strategic planning will serve three purposes:

1. Provide a context for defining the markets and thereby the products and services to be delivered by the IC.
2. Provide a basis for establishing the internal consistency of the IC's plans.
3. Provide a basis for assessing the external validity of the IC's plans.

IC managers must direct the support provided by the IC to a community of users large enough to justify expenditures and assignment of staff personnel. It would not be a good business decision to provide Wordstar support to a small contingent if the long-range plans of the organization are to implement WordPerfect.

The plans envisioned by the IC managers must be correctly implemented and provide proper solutions to the organization's problems that the organization. It would be inappropriate to implement a database to solve a problem clearly calling for a spreadsheet application. This external validity ensures that attempts are not

made to solve problems with the incorrect conclusions. (Henderson, 1988)

For IC managers to make correct business decisions they must have access to the strategic plans of the high level managers. The manager must feel comfortable with the high level executives and base decisions on strategic plans that will benefit the organization as a whole. (Henderson, 1988)

2. Marketing the Information Center

Managers must approach marketing the IC with caution. Hammond (Hammond, 1982) recommends that the IC market only the services that they are confident can be delivered. As the IC becomes more stable and established as a permanent part of the organization, a more aggressive marketing strategy can be adopted. Care must be taken not to attempt a promotion level that would render the IC unable to fulfill its promises. The IC does not need the adverse publicity of not delivering what it advertised. (Carr, 1987)

Part of the marketing strategy should be to inform users and upper level management of the IC's contributions to the business effort. (Ambrosio, 1987) Managers should make every attempt to document the benefits described earlier. The more that users and upper level executives feel that they are getting out of the IC, the easier it will be justify the IC's existence.

3. Establishing the IC as a Profit Center

Future IC's will be increasingly judged on how much they contribute to profits on the organization's balance sheets. The IC's continued existence is very dependent upon how well the manager can account for budgets and expenditures. The key to the accounting task is to keep accurate records documenting expenses

and increased profits that use of the IC helped to generate. (Kelleher, 1986) These can be isolated through follow-up conducted with previous IC users. Staff members must take the time to visit users, view their applications, and let the users determine the extent to which cost savings or increased profits can be attributed to the application. The implementation of an automated system developed with the IC's help that subsequently saves the company money should be documented as an IC benefit. By the same token, the IC should shoulder the responsibility for systems that it developed that end up losing money for the organization. As in any business venture, if the IC wants to share in the profits it must also share responsibility for the loses.

Some kind of charging system must be used so that users are aware that the IC is not a free service. (Carr, 1987) Many firms use an overhead account system where all user departments pay into the IC's account for the services that they use. The system must also be flexible. At the time an IC is formed it could help promotion by having all services free. When users' acceptance of the IC increases and they understand the IC concept, a charging system can be phased in. The adoption of these sound business practices will give the IC manager indications of good and bad areas within the IC.

In the truest sense of the word, the IC is not really a profit center. User departments are not allowed to go outside the company for services, they must use the IC for any EUC services that they require. The IC can, however, operate as a pseudo-profit center with centralized funding for services that are offered regardless of user participation (e.g., basic wordprocessing training, software and hardware

evaluation) and a charge-back system for widely sought services such as application development.

4. Setting Priorities

Finally, it is important for the IC manager to set priorities for the IC based on the company's strategic plans, budget reviews, and user demands. It will be nearly impossible for the IC to support all requests, especially in the early development stages. The manager must prioritize needs and support those that can be accomplished within the IC's funding and manpower constraints. Again, solid business practices dictate that the IC must live within the profit/loss guidelines much the same as any other part of the organization.

This chapter has provided a perspective on model IC's in business organizations. It affords a comparison for IC's in the Navy described in later chapters. This comparison allows us to make recommendations on how the Navy can improve its IC's to foster and control EUC.

III. END-USER COMPUTING: A MODEL FOR CONTROL AND GROWTH

A. BACKGROUND

This chapter examines the growing phenomenon of end-user computing (EUC). The concept of EUC is discussed along with the major reasons that for its rapid evolution in today's business organizations. Four models of EUC control are discussed: Nolan's Stage model (Nolan, 1979); Huff, Monroe, and Martin's Growth Stages of EUC (Huff, Monroe, and Martin, 1988); Alavi, Nelson, and Weiss' Integrative Framework model (Alavi, Nelson, and Weiss, 1987-88); and finally Euske and Dolk's model (Euske and Dolk, 1988).

EUC occurs when computing applications are developed outside the normal MIS channels by the individuals actually performing the applications (Euske and Dolk, 1988). It is the use of computers by someone who is not a DP professional to solve their business related problems. EUC bypasses the systems analysts and programmers that normally author computer applications. This can cause problems within organizations if EUC control mechanisms are not established and maintained. Data integrity can suffer if end-users are granted uncontrolled access to company databases. Incompatibility can occur because not all end-users will agree on one standard system technology. Finally, redundancy in applications is possible if an organization such as the IC is not utilized as a clearing house for end-user developed applications. Word processing, spreadsheet, database, graphics and other

software packages that do not require a great deal of computer expertise have lent themselves well to end-users. (Rockart and Flannery, 1983)

B. EVOLUTION OF END-USER COMPUTING

EUC has become a muddled and perplexing situation in many organizations. (Rockart and Flannery, 1983) It has grown so rapidly that management control has yet to catch up. Estimates show (Goldberg, 1986) that by 1990, 80 percent of all computing will be conducted on end-user technology. Clearly, if EUC and personal computing continue to grow as expected, any organization will benefit from a management posture that provides control over EUC without stifling creativity.

> "You walk a really thin line in managing end-user computing .... You have to have some control, but without stifling innovation absolutely. We institute only those controls that will help us keep moving forward." (Goldberg, 1986, p. 77)

Various factors have contributed to the rapid rise of EUC. One of the factors is a vastly increased awareness of the potentials of EUC (Rockart and Flannery, 1983).

> A new generation of users has arrived which understands EUC and views it as a means of facilitating decision-making and improving productivity. (Rockart and Flannery, 1983, p. 777)

This new generation of users not only includes recent graduates with experience in wordprocessing, database, spreadsheet, and basic programming techniques but the older, more senior personnel who have been introduced to EUC by colleagues familiar with EUC's benefits. The experienced EUC managers extol the virtues of EUC to others who then want the same benefits for their organization.

Improvements in the technical capabilities of microcomputers that have made EUC more feasible and less costly is the second factor for EUC's growth (Rockart and Flannery, 1983). Both hardware and software advances have made microcomputers much more "user-friendly" through the use of pull-down menus, on-line user's manuals, mice, and other devices to entice potential users. The advent of optical disks has given microcomputers access to more secondary storage information than ever before. For example, a single compact disk containing the entire Encyclopedia Britannica can be used to provide end-users a wealth of needed facts.

A third factor cited by Rockart and Flannery for the rise in EUC is today's intensified and difficult business environment (Rockart and Flannery, 1983). The need for increased analysis, planning, and control, all more efficiently performed with the assistance of EUC, has risen in response to high interest rates and worldwide competition.

Finally, Rockart and Flannery note that users' computing needs are not satisfied through the traditional IS organization. Users often find the tools, methods, and processes used by the IS organization entirely inappropriate for their requirements. Even those that might be appropriate for solving the users' problems are only available after a prolonged wait, sometimes as long as two to three years. This situation was deemed unacceptable by most users. (Rockart and Flannery, 1983)

The rise in EUC has not been without problems. Dolk and Euske (1988) cite lack of control over information resource acquisition, hardware and software

incompatibility, and quality control as difficulties with which EUC managers must contend. With end-users purchasing the microcomputers that they feel they need, it is virtually impossible for an organization to assess the true cost of EUC spending. The monetary figures on microcomputer expenditures might be readily available but do not reflect the time that end-users spend working with their applications. This hidden cost can be quite expensive in terms of employee salaries. It is also quite possible that microcomputers purchased from different vendors will not be compatible. This could lead to individuals, possibly within the same office, not being able to share data or computer resources. Lastly, unless the end-user's applications are subject to some sort of quality control, the organization could suffer from end-users that make business decisions based on what could be erroneous data generated by programming errors.

To avoid the pitfalls of EUC left to proliferate on its own some form of control mechanism must be installed (Rockart and Flannery, 1983; Euske and Dolk, 1988). The question remains how do we classify these end-users and, once classified, what amount of control is appropriate and consistent with the organizations strategic goals?

C. CURRENT EUC CONTROL STRATEGIES

Most EUC control strategies that exist today have their roots in MIS control theory and are primarily bureaucratic in nature. Upper level management specifies the policy that is subsequently promulgated to and followed by the users. Euske and Dolk (1988) categorize four different control strategies dealing with EUC. These four methods of controlling EUC will have different emphasis within an

organization depending upon whether management's philosophy is primarily centralized or decentralized.

The first strategy concerns pricing mechanisms. A price is tied to a certain amount of CPU usage and the user is billed based on the amount of use. In the decentralized world of EUC, transfer pricing is not practical. The many individual microcomputers involved would be nearly impossible to monitor, as opposed to a central mainframe where account usage is easily observed. (Euske and Dolk, 1988)

The use of steering or screening committees to control software and hardware acquisitions is a second method of instituting control over EUC. These committees make all decisions regarding system configuration, applications, and standards regarding quality assurance and data integrity. (Euske and Dolk, 1988)

The use of IC's is the third method of EUC control cited by Euske and Dolk (1988). The IC can be utilized to train, educate, and control end-users simply by offering only the services that management wishes to promote within the organization.

The fourth control strategy for EUC is controlling hardware and software configuration. A good illustration of this is the LAN example provided by Euske and Dolk (1988). The LAN forces users to access certain applications or files. It can also be used to restrict access to specified disks. In this manner computer use is mandated much the same as it would be in a centralized mainframe. "In this sense, the architecture is being used as a control mechanism." (Euske and Dolk, 1988, p. 9)

Various models of the growth of EUC in organizations have emerged in the MIS literature. Most models are based on traditional bureaucratic MIS management concepts while others consider alternative approaches as a more viable way of explaining the unique EUC phenomenon. Four models of EUC control strategies are discussed in the next sections.

1. Nolan's Stage Model

The stage model of ADP growth originally proposed by Gibson and Nolan (1974) and later expanded by Nolan (1979) is the most well-known computer growth paradigm. The model has been given great attention in both academic circles and business organizations. (Alavi, Nelson, and Weiss, 1987-88; Huff, Monroe, and Martin, 1988; Euske and Dolk, 1988; White, 1987) It has formed the basis for most follow-on theories that attempt to model the growth of EUC. (Euske and Dolk, 1988)

Nolan divides computer growth in organizations into six stages describing the level of maturity attained. He proposes that management must understand the stages of computer growth and know where the organization falls within the model in order to better control computer resources. (Gibson and Nolan, 1974)

The initiation stage is the first described by Nolan and is characterized by the introduction of computer technology into an organization. Many accounting tasks are automated in this stage. However, the growth of computing remains relatively slow. The applications are concentrated on relatively simple tasks such as automating spreadsheets rather than the long-term impact of computers on the organization's personnel. (Gibson and Nolan, 1974)

The second stage is that of proliferation or expansion. This stage is characterized by a rapid growth of computing and its associated costs. As the ADP organization grows, its place within the organization continues to increase. Innovation and extensive computer-based applications are encouraged through lax controls that can be thought of as passively stimulating end-user development. (Nolan, 1979)

The control stage of computer growth is the organization's first attempt to centralize the computing resource. The uncontrolled growth that takes place in stage two inevitably leads to problems of quality control, incompatibility, and data integrity. The organization institutes cost controls and locates the computer in a specialized ADP department. (Nolan, 1979)

Nolan's fourth stage, integration, is distinguished by an increase in well-defined control mechanisms planned to make the computer resource more efficient. User perception of computer applications is one of real value to the organization in the control stage. (Nolan, 1979)

In the data administration stage the organization attempts to manage data as a resource, hence the ADP organization shifts its emphasis from managing the computer to managing the data, an emergence into database technology. (Nolan, 1979)

The final stage, maturity, is observed when the ADP department perfectly mirrors the organization's strategic goals. The computer resource is applied to all major functions of the organization. Because of ever-changing technology this stage

is seldom observed; the organization is forced back to previous stages from which it will continue to evolve. The six stages are detailed in Figure 3-1.

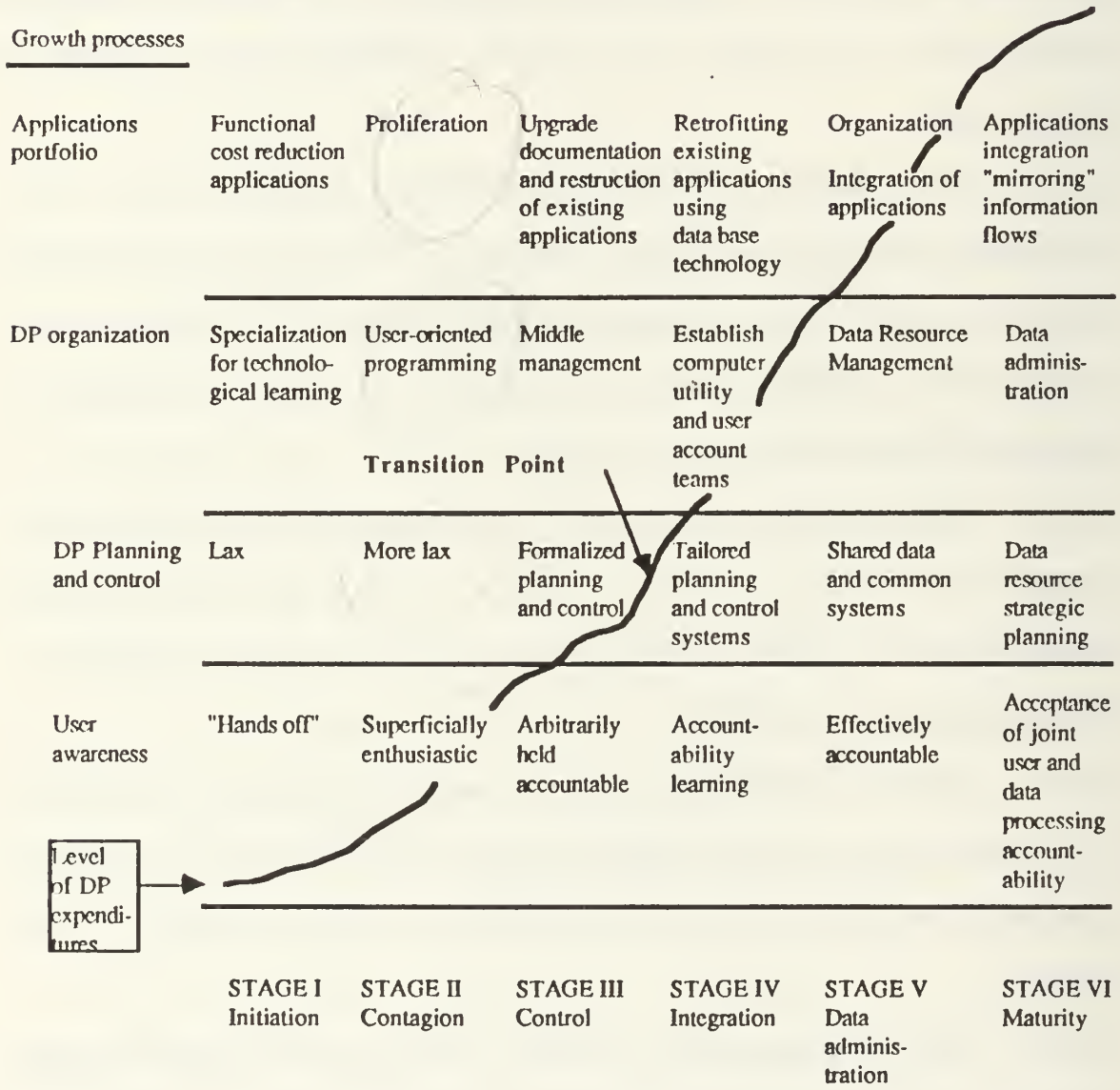

Figure 3-1. Six Stages of Data Processing Growth (Nolan, 1979)

Nolan argues that an organization can determine which stage of maturity it falls into by observing four main characteristics. First, the applications portfolio of information systems that are in use will change from functional, simple applications to more integrative organization-wide systems as the organization matures. Second, the DP department will shift from a centralized structure in a supporting role to a computer or data processing center functioning as a data custodian for the entire organization. As the organization matures DP planning and control will shift from lax to formal. User awareness of DP will shift from reactive to participatory as the level of maturity increases.

The stage model has been criticized (Benbasat, et al., 1984; Euske and Dolk, 1988) as being primarily bureaucratic in nature based on a rule-based system and hierarchical control. Although some components of Nolan's theory were verified by Benbasat's empirical study, overall evidence casts considerable doubt on the validity of the stage hypothesis as the definitive structure for the growth.

> The empirical studies surveyed...indicate that the various maturity criteria do not reliably move together, or even always in the same direction, thus refuting one of the requirements for claiming the existence of a stage theory. (Benbasat, et al., 1984, p. 484)

The model is important in that it provides one of the most popular models for describing and managing the growth of ADP. It has gained considerable acceptance among practitioners in the field and does offer managers guidelines on the behavioral aspects of managing computer personnel. Nolan presented a set of priorities for managerial attention contingent upon the organization's IS development.

This proactive approach was the first attempt at actually managing the computer resource. (Benbasat, et al., 1984)

2. Huff, Monroe, and Martin: EUC Growth Stages

Huff, Monroe, and Martin develop a model that describes EUC maturity as a function of the applications developed by end-users. (Huff, Monroe, and Martin, 1988) The authors argue that different levels of end-user maturity will exist in an organization simultaneously. As end-users mature they will require increasingly sophisticated applications and new end-users will arrive to fill the gap at the lower end of the spectrum.

> EUC organizational training, support, and managerial activities are thus driven by individuals striving to acquire new skills and solve problems by developing more complex and mature applications. (Huff, Monroe, and Martin, 1988, p. 543)

Application maturity is measured in terms of the interconnectivity of the applications with other components of the surrounding end-users. The extent of the interconnectivity indicates the level of maturity of EUC. Five stages of maturity were identified: isolation, stand-alone, manual integration, automated integration, and distributed integration. (Huff, Monroe, and Martin, 1988)

In the isolation stage, most EUC applications are primitive and little exchange of data between applications occurs. No formal support for EUC exists in the organization and those intrepid end-users that do create applications must rely on contacts in the DP department for informal support. Those without contacts in DP receive only as much support as their budget will allow.

The stand-alone stage is characterized by the applications becoming part of the end-user's job activities. The applications are still restricted in scope to the individual user or the users' work group. Any data that is passed to other applications is done through manual re-keying. A growing dependence on the applications is observable in the stand-alone stage. (Huff, Monroe, and Martin, 1988)

The manual integration stage occurs when applications maturity develops to the point where end-users exchange substantial amounts of data or programs with other end-users. Key to this stage is that the exchange is independent of the applications and must be performed manually. Usually, disks are hand carried from user to user or files are transferred back and forth from microcomputer to microcomputer or mainframe via a LAN. (Huff, Monroe, and Martin, 1988)

The automated integration stage is marked by the advent of applications that automatically transfer data back and forth between end-users. All types of systems (i.e., micro to micro, micro to mainframe) are linked but the user is still required to perform the navigation necessary to locate and access the required data.

In the final stage, distributed integration, end-users operate in a world of shared databases in a three-tiered environment: desktop, departmental, and corporate. The applications can access all data regardless of its location or format. (Huff, Monroe, and Martin, 1988) It must be noted that this stage is dependent upon the further development of distributed database technology.

In their criticism of the EUC stage model, Euske and Dolk argue that it is largely based on Nolan's bureaucratic stage model and requires users to conform

to certain rules in order to reach higher levels of maturity (Euske and Dolk, 1988). This criticism is valid when viewed in the context of EUC. As users become more knowledgeable they will be in a position to violate the rules and demonstrate that their way makes sense. They will not necessarily conform to rules simply because they exist. The model is also focused on the architecture and connectivity of the computer system as a measure of the end-user's maturity. Following this line of reasoning, as technology increases so will EUC maturity.

3. Alavi, Nelson, and Weiss: An Integrative Framework

Alavi, Nelson, and Weiss (1987-88) argue that an explicit organizational strategy for managing end-users is needed as a prerequisite for successful and effective EUC. A strategy should consist of processes and approaches for identification, assessment, and assimilation of end-user technologies into the organization. Those adopted will have direct impact on EUC growth. For example, a strategy based on strict controls over EUC will slow growth while a strategy that encourages EUC technologies will result in widespread adoption of EUC applications (Alavi, Nelson, and Weiss, 1987-88).

> In fact, development of an effective end-user computing strategy may be the most important short-term decision the organization can make if it hopes to benefit from its investments in end-user-based technologies. (Alavi, Nelson, and Weiss, 1987-88, p. 29)

The authors describe five strategies - laissez-faire, monopolist, acceleration, marketing, and operations-based - that are used in controlling EUC. Each is discussed in greater detail in the following paragraphs and diagrammed in Figure 3-2.

The laissez-faire strategy is a "do nothing" or "wait and see" approach to EUC. Little or no effort is made at encouraging EUC while, at the same time, no effort is made to control or limit EUC activities. No central organizational policies and procedures for EUC exist.

> A laissez-faire strategy provides some degree of experimentation with EUC technologies and innovation, but the EUC growth is unanticipated and unplanned. (Alavi, Nelson, and Weiss, 1987-88, p. 30)

This strategy tends to promote uncontrolled growth and may lead to a proliferation of incompatible computer applications. As a result, it is often replaced with a more proactive strategy that provides some direction.

The monopolist strategy is based on firm, centralized control over all EUC activities. Control is maintained over EUC through formal review and approval mechanisms designed to slow EUC's growth and keep it within specified boundaries. In a monopolistic organization all computing activities are controlled by a central DP department that determines exactly what EUC activities will be allowed. The monopolistic strategy tends to break down in organizations that attempt to curtail growth of EUC. End-users, who are becoming increasingly computer-literate, demand the capabilities and resources to develop their own applications. If the capability is not provided the drop in the cost of EUC technologies allows end-users to purchase the required tools regardless of management policy. (Alavi, Nelson, and Weiss, 1987-88)

The acceleration strategy is almost the exact opposite of the monopolistic strategy. It focuses on increasing the satisfaction of end-users by building enthusiasm for EUC activities through education, support and consulting. A primary

vehicle used in acceleration organizations is the IC. This central support group provides end-users with the required tools to develop their own applications and creates an atmosphere fostering EUC. A problem inherent in the acceleration strategy is that little or no regard is given to the direction and form that EUC activities may assume. The IC's are allowed to function and grow unchecked without input from top management. As such, they often lack the overall perspective required to manage EUC and obtain the most beneficial results for the organization. According to the authors, this strategy leads to rapid growth of EUC, increased demand for high investment in EUC technology, and eventually user dissatisfaction with the organization's ability to meet their EUC needs. (Alavi, Nelson, and Weiss, 1987-88)

In the marketing strategy, EUC is developed at a predetermined rate along chosen paths that management supports.

> A marketing strategy is one of directed growth. End-users are viewed as consumers whose demand for EUC tools and services may be influenced through effective product design, advertising, and distribution. (Alavi, Nelson, and Weiss, 1987-88, p. 32)

The EUC support structure in the marketing strategy includes centralized as well as decentralized groups. The central group provides guidelines and direction to end-users as well as ensuring that a framework for EUC policy and control is formed. The decentralized group meets the individual needs of the users through technical, functional, and application knowledge. The authors emphasize that in the marketing strategy, the central drive for guiding EUC activities must remain strong. If it

weakens, the marketing strategy then reverts to acceleration. (Alavi, Nelson, and Weiss, 1987-88)

	Strategies				
Characteristics	Laissez-faire	Monopolist	Acceleration	Marketing	Operations
Objective	"Do nothing"	Contain and restrict EUC activities	Encourage and expand EUC activitiies	Expand EUC activities in certain form and directions	Obtain integration and efficiency in EUC activities
Emphasis	"Hands-Off" approach to EUC	Implementation of explicit controls Formal approval procedures	Provide support and broad-base education Highly responsive to end-user needs	Provisions of value added products and services Shaping the EUC demand	Standards Formal cost/ benefit analysis
Organizational structure	No formal structure	Management information systems/data processing department active in EUC containment and control	Centralized general support facility (e.g., IC)	Centralized facility for planning and coordinating Departmental support	Centralized planning, prioritization, and monitoring Departmental support and enforcing standards and control
Level of Control	Very low	Very high	Relatively low	Relatively high	High

Note: IC: information center

Figure 3-2. EUC Computing Strategies (Alavi, Nelson, and Weiss, 1987-88)

The operations-based strategy maximizes the efficient use of equipment, software, and personnel through centralized control procedures, enforced

technological standards and formal EUC planning activities. EUC resources are often integrated through the use of LANs to integrate their use and promote maximum efficiency. (Alavi, Nelson, and Weiss, 1987-88) An operations-based strategy is a high-control strategy. All EUC direction is pushed down from top management. Although its aim is efficient use of resources, the inherent controls cannot help but stifle creativity.

Although the model presented by Alavi, Nelson, and Weiss covers the spectrum of control it is still firmly rooted in traditional MIS bureaucratic thinking (Euske and Dolk, 1988). Control mechanisms inherent in a free-market structure are overlooked that might be used to direct EUC in accordance with the organization's strategic plans. Market pressure for applications that the organization wishes to promote can be exerted by management in the form of rewards, incentives, or recognition. The lack of market pressure will force unwanted applications to be abandoned much the same as free-market principles work in the economic world. By allowing a free-market environment to develop an organization could promote EUC that would regulate itself.

4. Euske and Dolk: An Alternative to the Stage Model

Euske and Dolk (1988) offer a model that moves away from the traditional bureaucratic MIS viewpoint. Their design focuses on a norm-based model, based on increased end-user intelligence and willingness to accept certain informal rules, and a virtual-market model, based on the efficient use of end-user time. (Euske and Dolk, 1988)

The norm-based model relies on informal standards of control specific to individual organizations. It relies heavily on the assumption that end-users' computing knowledge will continue to grow as they become more and more comfortable with EUC technologies. As this sophistication increases, norms will develop that define what are acceptable computing practices and what are not. These norms are the primary means of controlling EUC. (Euske and Dolk, 1988) Unlike bureaucratic models, the norms are informal; they are not written down by management but emphasized as the proper conduct for EUC through reinforcement of acceptable behavior. For example, one organization might allow users to use electronic mail for personal messages to friends. Another organization might not condone this activity. A norm can be established in the first situation by management inviting the staff to a party via electronic mail. In the second situation the norm could be established through a monitoring system and a well-placed note in the violator's mailbox as a reminder. It is important that the users know what is allowed and what is not.

Euske and Dolk view the norm-based model as a transition state between the bureaucratic model, where end-users have little refinement, to the virtual-market model, with sophisticated end-users, highly knowledgeable in EUC technologies. They also contend that the growth of EUC and IC's in organizations is forcing them toward the norm-based model. Organizations can choose which direction they wish to follow, bureaucratic or market-based, based on the amount of formal controls that they establish.

The virtual-market model assumes a high level of computer knowledge among the end-users. Individuals have the expertise to understand and use end-user technologies effectively and efficiently. For these "power users" end-user technology becomes a means of maximizing their output in terms of end-user time. The authors argue that, in this model, formal controls are not necessary because the users know the right choices to make and the marketplace controls itself.

> Users understand the function and capabilities of the technology and use it as a way to enhance individual productivity. The focus in this environment is on user productivity, not on the use of the technology per se. The technology becomes a means to and end rather than an end in itself. (Euske and Dolk, 1988, p. 18)

Today's children are growing up with computers in the classroom and at home. They are introduced to computer technology at an early age. For these young end-users it becomes a required tool throughout their development. In contrast, today's middle-aged generation view the computer as a technological innovation rather than a tool. As these new end-users mature the sophistication of EUC will increase dramatically. Euske and Dolk assert that the use of adaptive user interfaces dealing with the differing end-user knowledge base will allow EUC to grow as the computer becomes more and more an integral part of our lives. (Euske and Dolk, 1988)

The bureaucratic, norm-based, and virtual-market models described can be used by management for planning and control of EUC. Organizations can move to bureaucratic control by tightening the reigns over EUC or to the virtual-market model if the knowledge base of the end-users is sufficiently high. Associated with a move to the bureaucratic model will be a high cost in architectural design and

maintenance to ensure end-users do not violate the rules. The costs in a virtual-market model are in developing software that is generalized to allow different kinds of software and hardware to be interfaced. (Euske and Dolk, 1988) For example the virtual-market model must allow a user who chooses to use Lotus 123 on a Macintosh to interface with a user running Quattro on an IBM AT through the use of macros. These macros are in the early development stages and in the future for many organizations.

D. SUMMARY

This chapter has examined four popular models that can be used to describe EUC growth and control. It is important to note that while none of the models completely explain EUC growth, managers can learn from each and know that any path chosen to deal with EUC, be it total control or laissez-faire, will have long-lasting effects on EUC. Models based on rule-based systems suffer from their inability to control the new breed of end-user. All of the models share the weakness of inexperience. Computing and especially EUC are relatively new to the world of management. There is little historical basis for theory and much empirical evidence still remains to be gathered. EUC control and growth is not a problem that will go away if ignored; quite the contrary, ignoring EUC may allow its evolution down paths totally in opposition to the organization's long range goals.

To capitalize on the growing EUC resource, organizations will need to incorporate EUC planning into their strategic goals. To properly plan for EUC management must have some understanding of how it functions. The models discussed in this chapter allow management to identify where an organization is

situated and what steps are necessary to reach a desired stage. The following chapters will attempt to identify where the Navy is regarding EUC and what steps it can take to reach a desired stage.

IV. U. S. NAVY INFORMATION CENTERS: CURRENT POLICY

This chapter focuses on the chain of command that directs policy and operation as well as the current policies dealing specifically with IC's and generally with all IS systems. A discussion of Navy Industrial Fund (NIF) funding for IC's and its impact on development and direction is also presented. Finally, the development of two IC's, Naval Regional Data Automation Centers (NARDAC's) Washington D.C. and San Francisco, CA is described.

A. CHAIN OF COMMAND

Within the United States Navy, IC's currently exist as divisions of (NARDAC's) located at Washington D.C., and San Francisco, CA. The parent NARDAC's are the regional centers responsible for all ADP issues within their specified geographical areas. Although NARDAC's are located in most areas of large Naval concentration (i.e., Washington D.C., Norfolk, VA, Pensacola, FL, San Diego, CA, and San Francisco, CA), only NARDAC's Washington D.C. and San Francisco have implemented IC's. (Crowder, 1988) An organization chart depicting the entire chain of command appears in Figure 4-1.

The parent command for all NARDAC's is the Navy Data Automation Command (NAVDAC) located in Washington, D.C. NAVDAC coordinates and administers the Navy's non-tactical ADP program. (NAVDAC, 1982, p. iii) All policy and guidance issues concerning ADP are researched and written by NAVDAC staff personnel in conjunction with the Chief of Naval Operations

(OPNAV) Department of the Navy Information Resources Management (DONIRM) staff. Policies written by NAVDAC are published as OPNAV Instructions and the technical guidance supporting the policies is then documented in NAVDACs Technical Standards Publications. (Englebert, 1988)

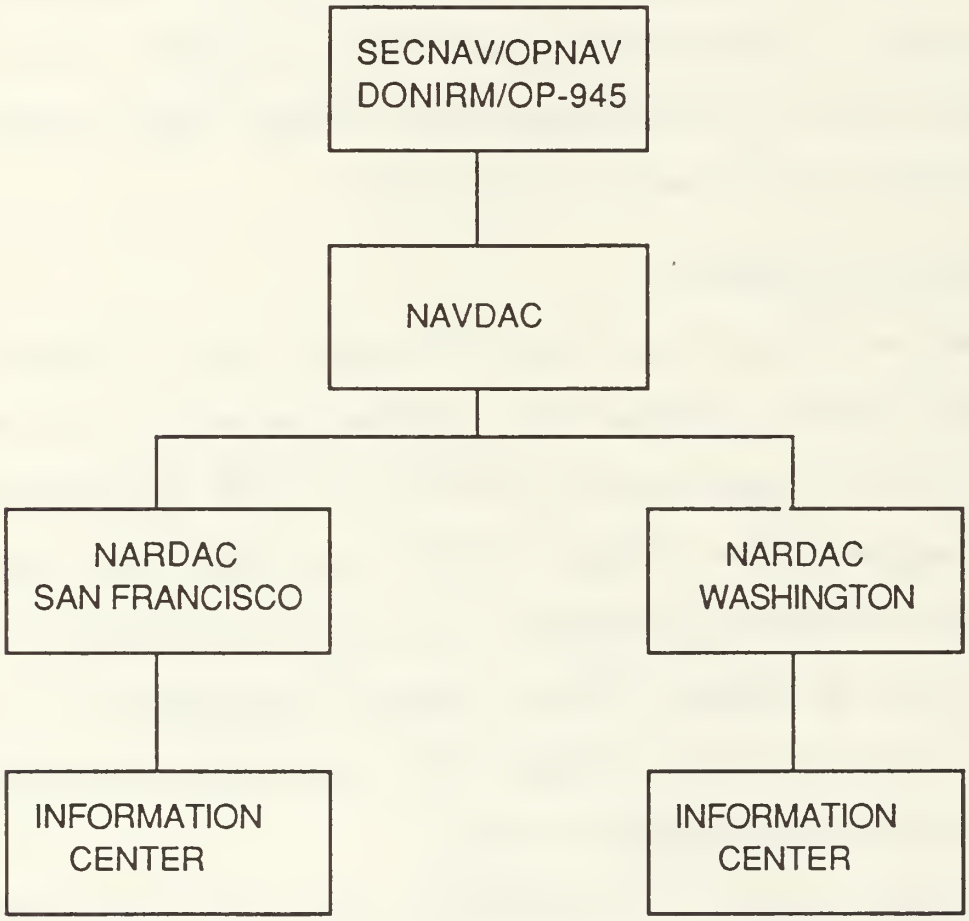

Figure 4-1. IC Chain of Command

DONIRM is the highest level of command within the Navy concerning ADP. DONIRM (OP-945), sets the policies that decide the future direction ADP will take in the Navy. DONIRM not only reports to the Chief of Naval Operations (CNO) but also functions in the same capacity for the Secretary of the Navy (SECNAV). (Conroy, 1988) DONIRM staff members are the counterparts of high level executives in a private sector business corporation. Their decisions set the tone and strategy for all non-tactical computer acquisitions. Any policy concerning IC's throughout the Navy would originate at the DONIRM level.

B. CURRENT INFORMATION CENTER POLICY

Policies that effect the implementation, operation, and viability of Navy IC's originate at any of three levels: OPNAV/SECNAV, NAVDAC, or the local NARDAC. This chain of command allows the DONIRM (OPNAV/SECNAV level) staff to concentrate on strategic direction and future systems acquisition. It also provides for the NAVDAC staff to implement the long-range planning of DONIRM as instructions and technical standards. Finally, the local NARDAC's are responsible for day to day operations and implementation of the policies and instructions originating at higher levels in the chain of command. (Conroy, 1988; Crowder, 1988; and Englebert, 1988)

1. OPNAV/SECNAV Information Center Guidance

No policy or future planning was uncovered at the DONIRM level of the chain of command that specifically addresses IC's throughout the U. S. Navy.(Conroy, 1988 and Englebert, 1988) With the exeption of the Navy Headquarters Information Center (NHIC) in the Pentagon whose implementation was

directed by DONIRM, local NARDAC's are not directed to implement IC's nor are they provided with any guidance concerning their operation. All decisions regarding the operation of IC's originate at the local NARDAC level and are based on individual market analysis conducted to determine if the local client population interest is large enough to support an IC. (Crowder, 1988)

The most significant policy statement at the DONIRM level is SECNAV INSTRUCTION 5231.1B, Life Cycle Management (LCM) Policy and Approval Requirements For Information System (IS) Projects. (SECNAV, 1985) This instruction provides a standard discipline for managing all IS projects throughout the Navy.

> LCM is a standard management discipline for acquiring and using IS resources in a cost-effective manner throughout the entire life of an information system. (SECNAV, 1985, p. 1)

The LCM strategy is a flexible discipline that provides managers with an approach to allocating their computer resources cost-effectively. Its goal is three-fold: to develop effective IS systems that provide accurate information on time to the people who need it, to manipulate the information as required at an affordable and acceptable cost, and to operate efficiently, providing the maximum benefit at the minimum cost. (SECNAV, 1985, Enc. (4):p. 1) It consists of five phases that guide the IS system through its entire life cycle.

Phase One in the LCM scheme is Mission Analysis and Project Initiation. In this phase managers must identify and validate a mission element need, determine significant assumptions and constraints on solutions and recommend alternative IS systems to satisfy the mission need. Management must determine whether or not a

problem or opportunity exists that is mission-related and worth solving. (SECNAV, 1985, Enc. (4):p. 2)

Phase Two, Concept Design, concerns the development and evaluation of alternative ways to satisfy the mission element need identified in Phase One. Management is required to choose between the competing alternative solutions based on economic analysis and modeling and simulation, and then recommend one or more feasible concepts for further consideration. (SECNAV, 1985, Enc. (4): pp. 3-4)

Phase Three, Definition and Design, focuses on the definition and validation of detailed functional requirements for the IS performance. Management then chooses the best system design and issues authority to begin full-scale system development. (SECNAV, 1985, Enc. (4): pp. 5-7) Basically, this phase is a much more detailed analysis of the alternative surviving Phase Two which culminates in the recommendation of one system to be developed.

Phase Four, Systems Development, is the development, integration, testing and evaluation of the chosen IS. The deliverable from this phase is a single, fully tested IS ready to be implemented. Again, an economic analysis is performed to ensure that the system is still the most cost-effective alternative. (SECNAV, 1985, Enc. (4):pp. 7-9)

Phase Five, Deployment and Operation, completes the life cycle for Information Systems. The system is operated in accordance with specifications, maintained economically, and evaluated periodically to ensure that it is meeting performance standards. When the system is rendered obsolete through technical or functional changes the IS is modified, replaced or terminated to satisfy the

requirements. The LCM strategy ends when the IS is terminated or replaced. (SECNAV, 1985, Enc. (4):pp. 9-10) A diagram of the LCM phases is provided in Figure 4-2.

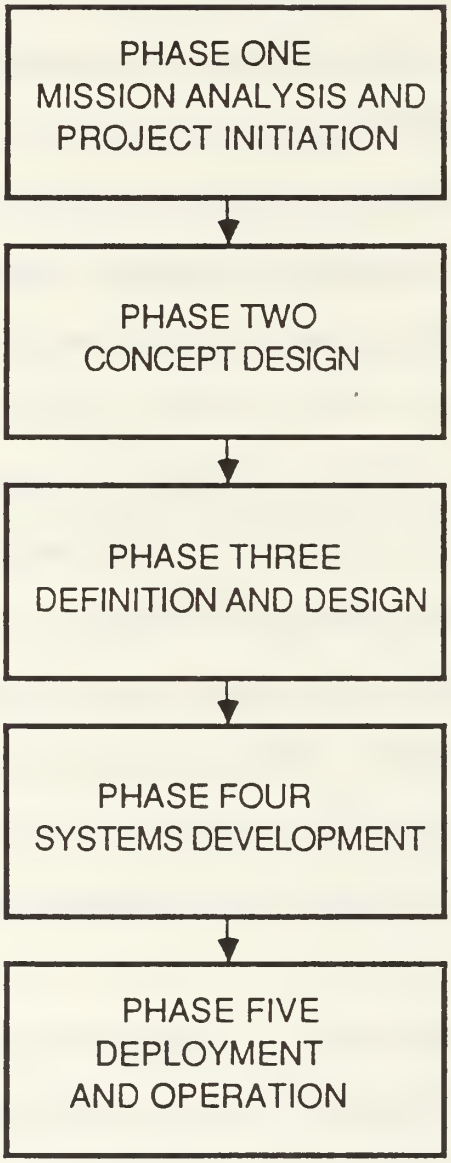

Figure 4-2. Life Cycle Management Strategy (SECNAV, 1985)

The thrust of the LCM policy is to ensure that all Information Systems are developed soundly, and based on solid economic and systems analysis and design principles. IC's, classified as IS projects, must conform to the LCM strategy if they are to be implemented. LCM policy forces all Naval Activities considering IS implementation to perform proper analysis and design. It is the single most effective policy statement that managers considering IC implementation can apply to ensure IC longevity. (Conroy, 1988; Crowder, 1988; and Englebert, 1988)

A major weakness of the LCM strategy is the failure of traditional cost-benefit analysis to quantify the decision variables required to determine if an information system is justified. The traditional cost-benefit analysis cannot quantify easily the intangible benefits that an IC can provide for an organization. For example, IC's have been shown to increase EUC sophistication, promote better business decisions, and foster harmonious end-user/DP department relations, all extremely valuable to an organization. (CRWTH, 1987) The cost-benefit analysis only examines quantitative values at the end of specific time periods. Management must be aware of the additional benefits that IC's can provide and include them in the decision process with the cost-benefit data.

2. NAVDAC Information Center Guidance

NAVDAC level policy concerning IC development, implementation, and operation exists only on the general level as technical guidance for the LCM strategy. (Englebert, 1988) NAVDAC is directed (SECNAV, 1985, p. 5) to provide LCM technical advice and assistance and to provide an independent third-party review, testing, and evaluation service to all component Navy activities.

Although NAVDAC does not specify policy concerning IC's directly, many of the software and hardware issues that concern IC management are addressed in various technical publications as part of the Naval Data Automation Technical Standards series. Microcomputer Software and Hardware Guidelines (NAVDAC, 1986) and Acquisition and Management of Small Computers (NAVDAC, 1984) are two publications that provide policy and technical advice for IC management.

NAVDAC's guide for microcomputer software and hardware provides the user with policy governing the preferred system configuration (16-bit, MSDOS operating system) for new acquisition by Navy users. (NAVDAC, 1986, p. 1) The guideline will help a user:

1. Identify factors to be considered in the evaluation and selection of microcomputer software and hardware.
2. Consider the selection of application software and databases that are compatible with microcomputer systems available from many vendors.
3. Obtain assistance and support from NAVDAC activities. (NAVDAC, 1986, p.1)

Acquisition and management of small computers is further discussed in NAVDAC's Advisory Bulletin 41. The guide provides procedures to identify and justify the need for small computers, indentifies directives applicable to their acquisition and use, and promotes the standardization and sharing of application software. (NAVDAC, 1984, p. 1)

IC managers have an existing control mechanism already in place in NAVDAC's Uniform NAVDAC Inventory and Query for Unique Exportables (UNIQUE) System. (NAVDAC, 1984, p. 3) The UNIQUE vehicle is an inventory

of application system abstracts that are available for use throughout the Navy. The system is monitored by NAVDAC and gives computer activities the ability to share software and reduce overhead. Although not directed at IC's, this policy is NAVDAC's attempt to control application software in the field and can be consulted when considering software for IC use. (NAVDAC, 1986)

3. NARDAC Information Center Guidance

IC's exist at NARDAC's Washington D.C. and San Francisco largely because key personnel at both locations were familiar with the concept and saw a need in the client population sufficient to justify the IC's existence. (Crowder, 1988 and Slater, 1988) Each IC operates independently, governed by mission goals and objectives determined through a needs assessment program, but with very little guidance from the parent NARDAC. IC Directors are free to structure the operation and services provided by the center as they see fit; there is no central strategy or direction provided by the Navy to coordinate the IC's development with the Navy's long range ADP goals. (Crowder, 1988; Slater, 1988; and Waite, 1988)

The most concrete guidance provided by the NARDAC's to IC management concerns funding constraints imposed by the Navy Industrial Fund that supports their operation. IC's must exist within NIF funding or face the possibility of extinction. (Slater, 1988) NIF funding, as explained in the next section, forces IC's to develop along certain paths that, from the NARDAC's perspective, might not always serve the end-users optimally in areas that do not return high monetary gains.

C. NAVY INDUSTRIAL FUND IMPACT

The Navy Industrial Fund is a revolving, working capital fund that is used as a source of financing for work that will be paid for later by the customer (PCM, 1982). It is used to finance the cost of industrial or commercial type activities, such as NARDAC's, in the Navy.

In a NIF funded activity obligations are initiated with the receipt of a funded customer order at the activity. The funded customer order gives the NARDAC a claim against the customer's funds. The funds obligated by the customer are then converted into service elements by financing the cost of personnel, material, and services needed to support the customer's order. The process culminates when the finished goods are delivered to the customer. (PCM, 1982)

NIF activities are also augmented at times through the use of direct appropriations into the fund. Major expansions, addition of services, or the need to stabilize the service rate would cause the fund to be augmented in this manner (Naval Postgraduate School, 1982). Initial establishment of new IC's would most likely be financed through an injection into the fund covering the initial set-up costs.

IC operations are affected by the NIF funding (Slater, 1988 and Waite, 1988). Managers are forced to concentrate on services that will provide the greatest return on investment and to virtually ignore services that from the IC management's perspective, might be important to end-users but do not offer as great an immediate or quantifiable return.

For instance at the IC, NARDAC San Francisco, the staff spends a great deal of time away from the IC at customer sites installing Local Area Networks (LANs). Because of the shortage of qualified personnel at the IC, services traditionally offered by IC's, such as software application training and testing, receive less emphasis. (Slater, 1988) The IC can offer the service of LAN installation, not traditionally associated with IC's, because it offers a large return on investment compared to offering classroom instruction. From a monetary standpoint, a staff member is better utilized spending a week away from the IC installing LANs than providing classroom education to end-users.

The operations of NARDAC Norfolk Va. offer a second example of the impact of NIF funding. Although NARDAC Norfolk does not have an IC, they have become known as the leaders in the microcomputer field in the Navy.

Many of the services offered by NARDAC Norfolk can be found in today's IC. The center has concentrated on microcomputers in the Navy and is the focal point for all Navy-wide microcomputer purchases. The large volume of business the microcomputer has brought to the NARDAC has allowed the staff to expand, offering many related services to end-users. The center offers Micro Exploration, a unique service providing demonstration and hands on experience, consultation, technical assistance, software development, training, publications, micro conferences, and remote bulletin board services to its users. (Chapman, 1988B)

In NARDAC Norfolk's situation the NIF funding concept has driven the center to become the expert on Navy-wide micro contracts and to offer services enhancing microcomputer development. Services such as Micro Exploration, which does not

offer extremely high return on investment by itself, are offered to increase the market base for microcomputer sales. Clients do not pay for Micro Exploration per se but the costs are recovered through overhead charged to microcomputer sales. As with NARDAC San Francisco's IC, the most emphasis has been placed on the areas offering the greatest financial gains. The LCM approach to information system procurement also influences the direction in which NARDAC Norfolk has evolved. Through cost-benefit analysis, the most financially rewarding services and products rise to the top and are offered to the NARDAC's end-users.

A case can be made for mission funding IC's allowing them to offer the services that IC managers feel are important to the end-users. Initially, end-users might not realize the importance of classroom education in the basics of computer operations, for instance, and would be reluctant to pay for those types of services. A gradual shift back to NIF funding would be possible once users see the benefits derived from ongoing education. The users would be more willing to pay for the services that they once felt were less glamorous and not required. Mission funding does not have to be an all or none situation. Services that are currently popular among end-users can remain NIF funded. Other, more basic services without great customer appeal but important to the users from the IC staff's perspective can be mission funded until the users value the service as described above. IC management must determine which services will remain NIF funded and which should be mission funded. The responsibility will also fall on IC management to ensure that a shift back to NIF funding is accomplished once users are willing to pay for a specific service.

D. NAVY INFORMATION CENTER DEVELOPMENT

The Navy's existing IC's have development histories that are remarkably similar given they were implemented separately with very little guidance from upper level management. The IC in the Navy Yard, Washington D.C. was the first to be implemented by NARDAC Washington. They have subsequently opened the Navy Headquarters Information Center (NHIC) in the Pentagon and have plans to open IC's in Crystal City for the Military Sealift Command (MSC) and the Naval Supply Corps Headquarters (NAVSUP). (Crowder, 1988) NARDAC San Francisco's IC developed after NARDAC Washington's Navy Yard Operation and thus benefitted from the experiences of the NARDAC Washington staff.

Both NARDAC Washington's IC at the Navy Yard and NARDAC San Francisco's IC were demand-driven. In each case NARDAC staff members perceived a need for teaching, systems use, and application development that they felt could be satisfied by an IC. (Slater, 1988 and Waite, 1988) The NHIC, on the other hand, was directed by DONIRM. NARDAC Washington was contracted to develop the NHIC as part of DONIRM's strategy for facilitating and managing EUC within the OPNAV and SECNAV users at the Pentagon (Waite, 1988). The three IC's that NARDAC Washington is planning are also demand-driven. The IC staff at the Navy Yard has pursued a fairly aggressive marketing and promotion strategy among the various commands headquartered in the Washington D.C. area. The result has been general acceptance of the IC concept and contracts from MSC and NAVSUP for IC's. (Crowder, 1988)

Each of the IC's has been tailored to support the computing needs of its clients. The IC at NARDAC San Francisco, for example, supports the word processing programs that the majority of its users are familiar with, specifically, the integrated software package Enable (Slater, 1988). The same is true for the IC's run by NARDAC Washington, however the most widely accepted word processing program among the end-users supported by NARDAC Washington is WordPerfect (Waite, 1988). Without any central policy the programs supported by the IC's reflect the regional popularity of the various manufacturer's products.

Finally, the IC's at NARDAC San Francisco and NARDAC Washington D.C. are placed at different levels within the parent organization. At NARDAC San Francisco the NARDAC is a relatively small organization (eight full-time staff) existing at the division level. The manager, although extremely experienced in data processing, is a junior officer. (Slater, 1988) NARDAC Washington's Navy Yard IC is a larger organization (30-40 personnel) enjoying departmental status and run by a full Commander (Crowder, 1988 and Waite, 1988). The placement differences become most noticeable when IC managers within the two organizations must defend their programs to their respective chain of command. IC managers interviewed for this study said that it is a much easier gap to bridge for a Commander than for a Lieutenant Junior Grade when it comes to competition among rival departments for a limited pool of resources.

The IC concept is utilized in Norfolk without the overhead of a physical location. (Chapman, 1988B) NARDAC Norfolk provides services typically associated with IC's (i.e., microcomputer purchasing, training, software applications, and

forums for discussion of end-user issues) under the auspices of a microcomp support department. They do not call themselves an IC but perform all of functions. While this scheme appears to work well in this particular application, the ability of management to influence, support and control EUC is diminished by the lack of a central agency through which management can communicate strategy. (Chapman, 1988B)

In this chapter we examined the chain of command, the various levels of policy, and the issue of NIF funding as they apply to IC's. We also surveyed various factors in the development of IC's within the Navy. This foundation characterizes the Navy's current position with respect to IC's and EUC. It provides us with a basis for investigating alternative directions the Navy might choose to support EUC through the IC's.

V. THE FUTURE OF END-USER COMPUTING IN THE NAVY

This chapter examines the current state of EUC in the Navy with respect to the models previously discussed and proposes several methods of progressing to alternative stages of EUC development dependent upon the strategy that the Navy chooses to adopt. It is argued extensively in the literature (Alavi, Nelson, and Weiss, 1987-88; Hammond, 1982; Henderson, 1988; Huff, Monroe, and Martin, 1988) that unless some form of strategic planning is implemented for EUC, the overall sophistication of EUC in the organization will remain low. Problems in quality assurance and compatibility could arise having disastrous effects on the organization's operations. The alternatives presented in this thesis are (1) do nothing and remain in the current state, (2) increase bureaucratic controls, or (3) foster norm-based development. Each is discussed in terms of end-user awareness, the IC, planning and control, and the user's applications portfolio.

A. CURRENT END-USER POLICY

The Navy's current EUC control strategy can best be characterized in terms of Alavi, Nelson, and Weiss' (1987-88) laissez-faire approach, although elements of the Monopolistic and Acceleration strategies are present. In the laissez-faire approach, as described in Chapter III, little or no effort is made to control or limit EUC activities. Interviews (Conroy, 1988; Crowder, 1988; Englebert, 1988) with key management personnel in the Navy's IC chain of command document the conclusion that no central organizational policies and procedures exist for EUC. With the

exception of the two locally established IC's discussed in Chapter IV the Navy has chosen to let EUC develop on its own.

> Due to the lack of policies and planning, end-user activities among the departments are uncoordinated and the data processing and EUC activities are carried out independently. No explicit EUC support structure exists. (Alavi, Nelson, and Weiss, 1987-88, p. 36)

The evolution of EUC within the Navy is not stagnant, however. As characterized by Alavi, Nelson, and Weiss (1987-88) the laissez-faire strategy is inherently unstable and may lead to uncontrolled growth and proliferation of incompatible EUC technologies and applications, for example Enable vs WordPerfect. Attempts to control EUC have been initiated through the adoption of a standard microcomputer architecture available through the contracts awarded to Zenith Corporation (Chapman, 1988B). It is not a firmly bureaucratic control mechanism; other microcomputers are available at the expense of significant time and paperwork; but it does signify that the Navy has attempted to influence one dimension of EUC by standardizing the acquisition of hardware. It is also an indication that the Navy is moving away from the laissez-faire strategy. EUC in the Navy is therefore at a pivotal stage in its developmental cycle. The decisions that Navy managers make regarding the amount and type of control needed will force EUC down distinctly different evolutionary paths.

B. LAISSEZ-FAIRE IMPLICATIONS

One option available for EUC managers in the Navy is to continue with the "hands off" approach characteristic of the current EUC control strategy. While this option is certainly the easiest to implement, it does have implications for EUC. The

laissez-faire strategy has a definite influence on user awareness, the IC, planning and control, and the end-user applications portfolio. These four measures of EUC sophistication offer management an indication of what results can be expected from different EUC control strategies.

User awareness as a whole under the laissez-faire approach will remain at a level of sophistication somewhat less than if management actively promotes EUC throughout the Navy. A great deal of EUC growth is stimulated by the consulting and training provided by self-made "local" experts or power users who have taken the initiative themselves to promote EUC activities (e.g. NARDAC Norfolk). (Alavi, Nelson, and Weiss, 1987-88) Should the Navy decide to continue with its present strategy, users can be expected to remain relatively ignorant of the end-user technologies that surround them in the business world. Management does not provide incentives for EUC in the laissez-faire strategy. Without such incentives it is less likely for users either to increase their EUC skills or to control EUC compatibility and quality. Less EUC growth across the population can be expected Navy wide than if management supported the EUC process. Most growth will occur as a result of the enlistment of previously knowledgeable end-users and their impact on fellow end-users.

The laissez-faire strategy can be equated to the isolation stage of Monroe, Martin, and Huff (1988). They also characterize user awareness as being very low, in fact most users are unaware that an IC exists to support them. Most end-users do not understand the need for compatibility, integrity, and the quality of information resources. (Monroe, Martin, and Huff, 1988) Those that do cannot find

a means of promoting them within the organization. The laissez-faire strategy does allow users to experiment freely with EUC technologies in the Navy; those users with an operating budget that will support the purchase of EUC technologies can do as they choose with the system. However, if policy makers decide on a truly laissez-faire or isolation strategy the overall sophistication of EUC awareness in the Navy is not likely to rapidly progress beyond isolated and relatively primitive levels. (Alavi, Nelson, and Weiss, 1987-88)

The IC in a laissez-faire or isolation stage is still in its formative stages and may suffer from a lack of funding resulting in its inability to support more than a few software or hardware products. The IC manager is confronted with a range of difficulties.

> ...too little staff for the number of problems, an expert image without real expertise, responsibility without authority (especially over technology acquisition and EUC direction), lack of a clear mission, low organizational profile, and staff with a strong technical focus but a weak function/problem area focus. (Huff, Monroe, and Martin, 1988, p. 545)

The training provided by the IC in this stage is mostly internal to the IC consisting of user self-instruction or vendor courses monitored by the IC staff. The IC might offer product demonstrations but the staff has little time to evaluate software and make recommendations to the end-users. (Huff, Monroe, and Martin, 1988) The IC exists in the laissez-faire or isolation stage but the staffs' hands are tied by upper management's inaction. They are unsure of where they stand in the organization and therefore unable to influence the direction of EUC.

The IC's at San Francisco and Washington, and NARDAC Norfolk's Microcomputer division have progressed passed this initial isolation or laissez-faire

stage in most respects. All three installations offer local training programs in wordprocessing, database, and spreadsheet applications. They also offer system design, consulting, and hardware and software purchasing through the available microcomputer contracts. (Crowder, 1988; Chapman, 1988B; Slater, 1988)

The microcomputer division at NARDAC Norfolk has progressed even further toward norm-based support for EUC. NARDAC Norfolk has influenced EUC direction through the process of establishing and reinforcing accepted patterns of behavior (i.e, norms) rather than bureaucratic direction. They support microcomputer conferences dealing with EUC issues, desk-top publishing applications, demonstrations of particular hardware and software products, user groups for different applications (i.e., WordPerfect, DBase III Plus, and Lotus 123), and bulletin boards for software sharing. NARDAC Norfolk also publishes the newsletter "Chips", one of the few documents dealing exclusively with EUC issues. Topics addressed range from the Z-248 contract to LAN operations and pitfalls. (Chapman, 1988B)

The IC's are well on their way to providing the norm-based support that could promote EUC growth. The problem is that they are only regional centers and do not reach all end-users throughout the Navy. For example, any user that happens to be stationed overseas would find it very difficult to use any of the IC's services. A statement from NAVDAC addressing the benefits of establishing IC's would go far in broadening the EUC knowledge base throughout the Navy as opposed to the localized groups of knowledgeable experts that currently exist.

Planning and control are lax in the laissez-faire strategy. No definitive statements of policy exist giving the end-users direction in application selection. The lack of a framework results in no financial controls over EUC technology and no development and operations standards are in place for end-user applications. (Alavi, Nelson, and Weiss, 1987-88) As discussed in Chapter IV, the policy that was identified specifically dealing with EUC is limited to the NHIC in the Pentagon. (Conroy, 1988; Englebert, 1988; Crowder, 1988; Waite, 1988) Navy-wide EUC is not addressed. Most existing policies deal with system acquisition and technical evaluation rather than end-user issues. The most obvious exception is the Zenith microcomputer contract. Hardware standardization and financial controls are stipulated in the contract. This example is further evidence that the Navy is moving away from the laissez-faire stage.

In the laissez-faire strategy the applications portfolio can include just about any level of sophistication from strictly functional (i.e., payroll, inventory management) to decision support systems based on artificial intelligence and developed by local experts. For the most part, however, the applications will be primitive and not involve the exchange of data with other applications. The majority of applications that Navy IC's help users with are stand-alone. (Waite, 1988) Again, there are exceptions. The Navy Headquarters IC is currently helping with the implementation of a LAN in the Naval Intelligence Command's budgeting shop. This LAN will receive data from subordinate commands' budget inputs, compile the data, and forward a consolidated report to the Secretary of the Navy's office for further review. (Chapman, 1988A) However, this application is the

exception rather than the rule. Most applications are for stand-alone systems or LAN's that only provide for the sharing of software and electronic mail, not the passing of data from application to application. (Slater, 1988; Waite, 1988) "Applications serve more to promote understanding than to perform substantial work-related tasks." (Huff, Monroe, and Martin, 1988, p. 543)

It is clear that as more sophisticated end-users enter the Navy the pressure on management to abandon their "hands off" approach in favor of a more definitive strategy will increase greatly. Two options that are open to EUC managers are to tightly control EUC through strong bureaucratic policies or to foster more of a norm-based development strategy through emphasis on proper conduct vice strict regulations. Assuming that the end-users' knowledge level increases to the point where they are mostly power users and local experts, then a third option, the market-based strategy would be open to the Navy. (Euske and Dolk, 1988) Considering the current EUC knowledge level in the Navy, this option remains in the future.

C. INCREASED BUREAUCRATIC CONTROLS

An environment where bureaucratic controls are used to restrict EUC activities closely resembles the monopolistic strategy described by Alavi, Nelson, and Weiss (1987-88). In this strategy explicit procedures, economic justifications, formal reviews and approval processes are established for the acquisition of EUC technologies. Stringent standards are published in an effort to contain EUC growth.

Many control mechanisms exist in the bureaucratic approach. Formal chargeback systems, development and operational standards, and audit and review

teams can be used to ensure that end-users comply with the written policies. (Alavi, Nelson, and Weiss, 1987-88) EUC growth and sophistication are not important measures in the bureaucratic design. Instead, compliance with regulations is monitored to determine the organizations effectiveness.

In the bureaucratic model, minimal knowledge of computing is required. User awareness is not focused on computing ability but rather on the users' ability to understand the rules and how to stay within them. (Euske and Dolk, 1988) EUC does very little growing under the bureaucratic model, except along the published guidelines, no matter how narrowly defined they are.

The IC in the bureaucratic model takes the form of a centralized computer center through either physical location or networking. (Euske and Dolk, 1988) EUC is dealt with much the same as any other DP function; centrally controlled from the top down via policy, rules, and regulations.

Planning and control are all important mechanisms in this model. More often than not, however, the planning does not consider the long range integration of EUC into the organization but rather is restricted to the best methods for ensuring compliance with directives. As mentioned earlier controls are in place throughout the organization covering all aspects of EUC.

In the bureaucratic model the applications portfolio is primarily functionally oriented. (Euske and Dolk, 1988) End-users have little opportunity to experiment with applications that deviate from published procedures. Applications may move out to user locations as the organization matures and away from the central DP center (Nolan, 1979). Although decentralized, the applications will still be

controlled by the DP center unless the tight monopolistic policies are eased allowing end-users some flexibility in designing their own applications.

Strong bureaucratic control over EUC would probably be the second easiest strategy to adopt. Managers could easily extend existing standards for traditional DP centers to cover EUC. Tight controls over acquisition of hardware and software, data availability, and application specification can all be published and enforced through a centrally managed program. While this would provide the desired controls, the growth of EUC would likely suffer from these restrictions. (Alavi, Nelson, and Weiss, 1987-88) The establishment of bureaucratic controls does not mean that they would be effective in controlling EUC. Euske and Dolk (1988) argue that the very nature of EUC seems to be in conflict with these types of controls and could even be cyclical. The establishment of EUC controls leads end-users to circumvent the controls which then leads to even more controls, and the cycle repeats itself. The costs of these control mechanisms in personnel, hardware, software, and management attention could be extremely high.

D. FOSTERING NORM-BASED DEVELOPMENT

The norm-based model proposed by Euske and Dolk (1988) offers the Navy the greatest opportunity to promote the growth of EUC while insuring that adequate controls are in place to protect the organization from incompatibility. Euske and Dolk contend that the norm-based model is a transitory state that is developing as a result of the EUC phenomenon and the emerging IC's. From the norm-based model, organizations have the choice of reverting to the bureaucratic model through

enactment of monopolistic controls or evolving to a virtual-market strategy by allowing a free market situation to develop.

User awareness in the norm-based model assumes a higher level of computer literacy than that required by the bureaucratic model. For example, the users might understand basic programming and operations in a database program but know little about normalizing database files. Users don't have to be DP professionals, however. A level of knowledge somewhere between the two extremes would allow the norm-based archetype to develop. Dolk and Euske's virtual market model (1988) assumes a much higher level of user awareness, such as that found in a typical computer company today. Because of the Navy's level of expertise it is unrealistic to adopt a virtual-market strategy at this point. By adopting the norm-based strategy, movement toward the virtual-market model is possible as the sophistication of EUC continues to grow.

The IC is prevalent in the norm-based model. DP personnel assigned to the IC are part of a service center; offering applications to end-users and helping them work with the particular hardware and software best suited to their problems. The role of the IC staff is one of directing the less knowledgeable end-users toward possible applications, rather that directing absolute solutions as in the bureaucratic model. As end-user sophistication increases the model shifts toward more of a market-based strategy. The relationship between the IC staff and the users evolves from the expert-novice footing to one on a more equal basis. The staff become brokers, transferring applications within the organization model, not unlike what NARDAC Norfolk is currently attempting with the end-users in their geographical

area. Again, it is the level of end-user sophistication that will allow the virtual-market model to develop. (Euske and Dolk, 1988)

In the norm-based model planning and control also differ from the bureaucratic model.

> Planning becomes more a means to describe the existing norms. Control is implemented via the informal norms which are the vehicle for maintaining "standards". (Euske and Dolk, 1988, p. 23)

There is less written policy in the norm-based model specifying exactly what is and is not allowed. Instead, the policy reinforces acceptable behavior through established norms. For example, former Secretary of the Navy Webb chose WordPerfect as the standard wordprocessing software for his office. He wrote a policy statement that informed the rest of the Navy that his office was now using WordPerfect and anyone wishing to communicate with the office could do so more effectively using that software. In effect, he established a norm for wordprocessing software throughout the Navy, without establishing a formal standard. (Crowder, 1988)

The applications portfolio also evolves in the norm-based model from purely functional to a decision support system orientation. (Euske and Dolk, 1988) The portfolio's sophistication increases as the end-user's computer knowledge grows. Some incompatibility will be present in the norm-based model but the informal pressure to find a common tool acceptable to all end-users can hold incompatibility down to a level that does not adversely effect the organization's daily operations.

Dolk and Euske (1988) hypothesize that EUC is forcing organizations into the norm-based model. Organizations then have the choice of evolving to the virtual-

market model or of reverting to the bureaucratic strategy through additional formal control mechanisms. They argue that increases in the users' computer knowledge and changes in technology will cause existing norms to be violated. These old norms are then replaced with new norms if the organization has chosen the norm-based/virtual market evolutionary path or with strict standards if the organization reverts via the norm-based/bureaucratic path.

It would be very easy, in fact expected (Euske and Dolk, 1988), for the Navy with its strong roots in mainframe and tradition MIS management to adopt the bureaucratic model for the control of EUC. Many of the policies that govern computer acquisition (SECNAV, 1985; NAVDAC, 1984) are firmly entrenched in bureaucratic management. The Zenith contract for microcomputers could easily become the rule rather than the most convenient option. However, if the goals of the Navy are to increase EUC sophistication the bureaucratic model is not a means of achieving that end. Bureaucratic controls will tend to stifle EUC and would be extremely costly to enforce. The norm-based/virtual market models offer a greater opportunity to enhance EUC throughout the Navy. The IC's that currently exist are influencing norm-based development. They help to establish norms through the services, hardware, and software that they offer. By increasing the presence of IC's throughout the Navy, leaders would be encouraging EUC without wrapping end-users in shrouds of stifling bureaucratic controls.

VI. CONCLUSIONS AND RECOMMENDATIONS

The role of the IC in supporting EUC will continue to grow in the Navy as personnel become increasingly computer literate through training of current end-users and the enlistment of proficient recruits. In an attempt to determine how the IC must function in this environment, a solid understanding of the IC, its history, organization, and implementation is necessary. It is also crucial to have a firm grasp of EUC. The phenomenon of EUC is pervading every organization in the business world. The Navy is no exception. In order to capitalize on this valuable resource it must first be defined and modeled so that it can be directed along paths beneficial to the Navy.

The IC has existed in the business world since the early 1980's when Hammond's (1982) work established the framework of an IC within IBM as a new user-IS partnership having value throughout the organization. Users benefit from the IC because their computing needs are satisfied more quickly whereas IS staff benefit because they now have more time to address the long-range project development essential to the continued growth of the company.

Organization and implementation are the first issues that must be addressed when planning an IC. The support provided by the IC must fit with the organization's philosophy and mission and must also correspond with end-users' abilities. If the larger organization is centrally controlled through a bureaucratic structure, an IC that attempts direction through enforcing norms will not conform as

well to the corporate structure and could be considered out of place in the organization. By the same token, an IC that provides instruction in complicated programming applications might not be successful if the majority of end-users is new to computers and requires more basic instruction. Managers with a definitive plan of action for the level that the IC will occupy in the organization, the staff make-up, the facility, the hardware, and the software stand a much better chance of having the IC accepted in the organization by both management and users, and thus reaping the benefits that IC's have to offer.

Many benefits have been cited for operating IC's such as increased job productivity, more computer literate end-users, an enhanced view of the DP department, and improved decision making.(CRWTH, 1987) While the benefits of EUC are compelling, the IC may be jeopardized by several obstacles such as management resistance to the IC because of the inability to justify resources. Also, the most pervasive deterrent to the success of IC's is still the lack of qualified instructors to train these new and enthusiastic end-users. (CRWTH, 1987)

The EUC concept is a relatively new phenomenon in the history of computing. It occurs when users develop their own applications outside of the traditional MIS channels and then use these applications to accomplish their job functions more efficiently and effectively. EUC is growing rapidly in society and in the Navy. The technical improvements in microcomputer capabilities coupled with the proliferation of computer literacy in the business world are viewed as two of the main reasons for EUC's swift growth.

Nolan (1979); Huff, Monroe and Martin (1988); Alavi, Nelson, and Weiss (1987-88); and Euske and Dolk (1988) offer models of EUC that can help managers understand its basis and direct its growth along paths compatible with the organization's strategic goals. Nolan's stage model divides the growth of computing into six distinct echelons; initiation, proliferation, control, integration, data administration, and maturity. Nolan argues that as organizations incorporate ADP into their structure, they will proceed through the stages until changes in technology force it back to previous stages from which it continues to evolve.

Huff, Monroe and Martin (1988) offer a model based on the maturity of the applications developed by end-users. They measure maturity as a function of an application's interconnectivity with other applications and divide it into five stages: isolation, stand-alone, manual integration, automated integration, and distributed integration. The authors argue that as end-users mature and progress toward higher levels, they are replaced by new users hungry for the technology they see employed by their peers.

The integrative framework proposed by Alavi, Nelson, and Weiss (1987-88) also describes five stages of EUC: laissez-faire, monopolistic, acceleration, marketing, and operations-based that are based on management's attempts to control EUC. The authors argue that the amount of management control over end-users has a definite impact on the growth of EUC. The greater the level of control, the less EUC sophistication will grow.

Dolk and Euske (1988) offer a model for EUC that, unlike the previous three, is not based solely along the traditional bureaucratic DP lines of thinking. Nolan

(1979); Huff, Monroe, and Martin (1988); and Alavi, Nelson, and Weiss (1987-88) require end-users to abide by certain rules generated in a bureaucratic context. By their nature end-users do not fit into systems based on rules; they are constantly experimenting with new-found technology in search of more effective methods. Microcomputers have given the end-users a tool with which to challenge long-standing DP practices. Euske and Dolk's norm-based and virtual-market models are alternatives that, base upon the analysis in this thesis, may be useful in managing EUC.

The fact that IC's exist in today's Navy shows that there is at least a small amount of support being offered for EUC, most coming from the NARDAC's. The policies addressing EUC in the Navy address local groups of users, not EUC as a Navy-wide issue. The IC's themselves are encouraging norm-based development through the many end-user services that they offer. However, they can only reach a limited number of users due to their geographic boundaries. The policies affecting IC's are mostly general instructions dealing with the acquisition of computer resources throughout the Navy. IC's are not directly addressed in any policy, with the exception of the NHIC in the Pentagon, but fall under NARDAC procedures simply because of their chain of command.

The NIF method of funding clearly has an impact on the IC's operation. While it does encourage the IC to "earn its keep" it provides incentives to offer services that depart from the traditional IC concept of instructing end-users in the development of their own applications. NARDAC's should give consideration to mission funding IC's until users realize the importance of basic IC services. This

idea would provide an excellent topic for a follow-on thesis in financial management or computer systems. Further research is needed to determine whether this idea is feasible. Once end-users see the benefits of more knowledgeable personnel, and are willing to pay for the services, a gradual shift back to NIF funding would be possible.

The Navy's current EUC philosophy can be described best in terms of the laissez-faire stage. (Alavi, Nelson, and Weiss, 1987-88) While a "hands off" approach still seems to dominate the thinking of higher level managers, indications are that EUC has forced the Navy to react to its presence in the workplace. IC's are one example; regulations governing microcomputer acquisition (i.e., the Zenith contract) are another.

The future of EUC in the Navy is dependent upon the direction chosen for its control. One option is to do nothing. Localized pockets of end-users that benefit from the IC's services will continue to grow, while the majority of users will remain at a relatively low level of knowledge. Based upon the analysis presented in Chapters III and VI, this option is not in the best interest of the end-users and could have an adverse impact on the organization. A second option is to increase bureaucratic controls and deal with EUC as a traditional computer situation. Managers may control EUC with this option but may also tend to stifle its growth. Experimentation and search for more effective methods is frustrated in a rule-based system. A final option is to support EUC through norm-based policies that encourage DP centers to adopt the IC concept for promoting end-user technologies and incorporating them in the organization. It is recommended that DONIRM

address the issue of EUC in the Navy through policy that incorporates EUC in the strategic data processing plans for the future. This can be accomplished through statements that provide high-level management backing and support for IC's. An instruction originating at the DONIRM level that addresses EUC in the Navy through reinforcement of norms (Euske and Dolk, 1988) rather that bureaucratic regulations could have significant impact on EUC growth. While the instruction should state that an IC should exist at every NARDAC, it must not dictate that all IC's are required to support certain applications. NARDAC's should have the freedom to decide what is important. For example, DONIRM should not specify that IC's must support WordPerfect or Lotus 123, but allow the IC's the flexibility to determine what their users need. DONIRM could make it attractive for NARDAC's to implement IC's through incentives such as partial mission funding for some services as discussed in Chapter V.

A normative policy should also address the problems that could arise when hardware and software compatibility, data integrity, and quality assurance are not specifically dictated to end-users. Initially, the chain of command must be willing to accept a lesser degree of compatibility, data integrity, and quality assurance than would be expected in a bureaucratic environment. In areas where this may be unacceptable, bureaucratic directives may have to be issued, e.g. DONIRM may let compatibility be norm-based but issue directives on mainframe-to-micro downloading (or vice versa). Specific hardware configurations, software products, proper methods of insuring data integrity, and quality assurance can be reinforced through norms but will require more time than by regulating through directives. As end-user

sophistication increases, the end-users will regulate compatibility, data integrity, and quality assurance themselves. In this virtual market model (Euske and Dolk, 1988) management can expect the same or greater levels of compatibility, data integrity, and quality assurance as with bureaucratic control, however the added benefit is a population of sophisticated end-users.

It is also recommended that all NARDAC's examine implementing an IC as the vehicle through which management can encourage use of particular applications. A thorough examination of a NARDAC's end-user population will help in providing a profile of the services that an IC should provide. End-users' level of sophistication will vary from location to location. This variation requires that IC's be individually tailored, not centrally dictated. Once the NARDAC's understand the end-users' needs they should implement norm-based techniques for increasing the users' level of sophistication. Methods such as informative newsletters, user bulletin boards with free software that the IC wishes to promote, seminars, and CBT are all recommended as vehicles for increasing end-user awareness. IC's can also act as a clearing house for end-user generated programs. In this manner the IC can perform quality control on user's applications and promote the software that management feels is important to end-users. NARDAC's throughout the Navy should consult with NARDAC's San Francisco and Washington for guidance and information on the IC's and NARDAC Norfolk for methods of using normative techniques for increasing EUC sophistication. EUC is not going to be limited to the San Francisco and Washington D.C. areas. Its proliferation is worldwide and the NARDAC's must explore the methods discussed for supporting it throughout the Navy.

Norm-based development not only allows EUC to develop fully but, as it matures throughout the organization, allows the organization to adopt virtual-market strategies in the future. Although, this is an extremely long-range goal that may not be realized for fifteen to twenty years, EUC is nevertheless becoming more and more a reality with daily impact on all our lives. The need for a strategy that addresses and incorporates EUC is not going to go away; a strategy that is proactive and does not attempt to suffocate EUC by regulations will assist Navy leaders in managing this new computer resource.

It is inevitable that computer literate sailors will comprise the Navy of the future. It is not inevitable that the Navy wait until the future to decide on a management policy dealing with EUC. Through proper management the Navy can capitalize on end-users today and be prepared for their proliferation in the coming years.

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